energy harbor

Perry Nuclear Power Plant
10 Center Road
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

July 3, 2023
L-23-146

10 CFR 54

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Perry Nuclear Power Plant, Unit No. 1
Docket No. 50-440, License No. NPF-58
License Renewal Application for the Perry Nuclear Power Plant

Pursuant to 10 CFR Part 54, Energy Harbor Nuclear Corp. hereby submits an operating license (OL) renewal application (LRA) for the Perry Nuclear Power Plant (PNPP), Unit 1, to extend the current operating licenses an additional 20 years beyond the current expiration date.

Energy Harbor also requests renewal of the source, special nuclear material, and by-product licenses under 10 CFR Parts 30, 40, and 70 that are subsumed in or combined with the current PNPP OL.

On October 8, 2020, the NRC issued Amendment 191 to the PNPP OL (ML20216A354), which extended the PNPP OL expiration date approximately 7.7 months, such that it expires 40 years from the date of issuance of the full power operating license (FPOL) as opposed to the issuance date of the low power testing license (NPF-45). Therefore, with the requested approval of the enclosed renewal application, the expiration of the PNPP OL (NPF-58) would be extended from midnight, November 7, 2026, to midnight, November 7,2046.

On July 13, 2020, the NRC approved an exemption for PNPP from 10 CFR 54.17(a) and 10 CFR 2.109(b) Section 2 (ML20171A277) requirements that provide timely renewal protection to licensees that submit sufficient license renewal applications at least 5 years before the expiration of the existing license. The approved exemption allows Energy Harbor to submit an LRA for PNPP at least 3 years prior to the expiration of its existing license, and, if the application is sufficient, still receive timely renewal protection.

On April 14, 2023 (ML23110A788), Vistra Operations Company, on behalf of Energy Harbor Nuclear Corp. and Energy Harbor Nuclear Generation LLC, applied for an order consenting to transfer of the PNPP operating license (OL) from Energy Harbor Nuclear Corp. to Vistra Operations Company LLC (VistraOps). NRC approval of the license transfer is requested no later than October 2023. Therefore, it is anticipated that the license transfer from Energy Harbor Nuclear Generation LLC to VistraOps will be approved within the early review period of the enclosed LRA, and the PNPP license transfer change will be reflected in a supplement, if required, or the next annual update to this application, whichever comes first.

The enclosed LRA contains the information required by 10 CFR Part 54. The application contains technical information required by 10 CFR 54.21 and includes an environmental report prepared in accordance with 10 CFR 54.23 and Subpart A of 10 CFR 51.

In accordance with 10 CFR 54.21(b), each year following submittal of the LRA and at least three months before the scheduled completion of the staff's review, Energy Harbor will submit an LRA amendment identifying any current licensing basis changes that materially affect the contents of the LRA, including the Updated Final Safety Analysis Report (UFSAR) supplement.

PNPP LRA Appendix A, Table A.3, "License Renewal Commitments", provides a summary of the commitments made in the application. This summary will be updated as required throughout the LRA review process.

If there are any questions, or if additional information is required, please contact Mr. Mark Bensi, PNPP License Renewal Project Manager (440) 280-6179 or via email at mjbensi@energyharbor.com.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 3, 2023.

Sincerely,

Rod L. Penfield

Enclosure:

1. License Renewal Application

cc: NRC Region III Administrator
NRC Resident Inspector
NRR Project Manager
Executive Director, Ohio Emergency Management Agency,
State of Ohio (NRC Liaison)
Utility Radiological Safety Board

PERRY NUCLEAR POWER PLANT

July 2023

LICENSE RENEWAL APPLICATION

PREFACE

The following describes the location, layout, and editorial conventions in the Perry Nuclear Power Plant (PNPP) License Renewal Application (hereinafter referred to as "this application" or "the application"). Abbreviated names and acronyms used throughout the application are defined at the end of this preface. Commonly understood terms (such as U.S.) and terms used only in referenced document numbers may not be identified in this table. Regulatory documents such as NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, and 10 CFR Part 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants* (the license renewal rule), are referred to by the document number, i.e., NUREG-1801 and 10 CFR 54, respectively. References to the UFSAR are to the Perry Updated Final Safety Analysis Report.

Section 1 provides administrative information required by 10 CFR 54.17 and 10 CFR 54.19.

Section 2 describes and justifies the methods used to determine the systems and structures within the scope of license renewal and the structures and components subject to aging management review. The results of the system and structure scoping are provided in Tables 2.2-1 through 2.2-6. Tables 2.2-1, 2.2-2, 2.2-3 and 2.2-4 list mechanical systems, structures, and electrical systems within the scope of license renewal. Tables 2.2-5 and 2.2-6 list the mechanical systems and structures, respectively, not in the scope of license renewal. Section 2 also provides descriptions of in-scope systems and structures and their intended functions with tables identifying components and commodities requiring aging management review and their component intended functions. References are provided to the results of the aging management reviews in Section 3. The descriptions of systems in Section 2 identify license renewal drawings that depict the components subject to aging management review for mechanical systems, some structures, and for electrical station blackout. These license renewal drawings will be made available for NRC review.

Section 3 describes the results of aging management reviews of mechanical, electrical and structural components requiring aging management review. Section 3 is divided into sections that address (1) the Reactor Vessel, Internals, and Reactor Coolant System, (2) Engineered Safety Features, (3) Auxiliary Systems, (4) Steam and Power Conversion Systems, (5) Containments, Structures, and Component Supports, and (6) Electrical and Instrumentation and Controls. The tables in Section 3 provide a summary of information concerning aging effects requiring management and applicable aging management programs for component and commodity groups subject to aging management review. The information presented in the tables is based on industry guidance on the format and content of NUREG-1800, *Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants*. The tables include comparisons with the evaluations documented in NUREG-1801, *Generic Aging Lessons Learned (GALL) Report* as modified by applicable NRC Interim Staff Guidance (ISG) documents for license renewal.

Section 4 addresses time-limited aging analyses (TLAAs), as defined by 10 CFR 54.3. It includes identification of the component or subject and an explanation of the time-dependent aspects of the calculation or analysis. Section 4 demonstrates whether (1) the analyses remain valid for the period of extended operation, (2) the analyses have been projected to the end of the period of extended operation, or (3) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. Section 4 also confirms that no 10 CFR 50.12 exemption based on time-limited aging analyses as defined in 10 CFR 54.3 is required during the period of extended operation. The information in Section 4 fulfills the requirements for an evaluation of TLAAs in 10 CFR 54.21(c).

Appendix A, Updated Safety Analysis Report Supplement, provides a summary description of programs and activities for managing the effects of aging for the period of extended operation. A summary description of the evaluation of time-limited aging analyses for the period of extended operation is included. A listing of the license renewal commitments related to aging management programs and time-limited aging analyses for the period of extended operation is also included. Following issuance of the renewed license, the material contained in this appendix will be incorporated into the UFSAR. The information in Appendix A fulfills the requirements in 10 CFR 54.21(d).

Appendix B, Aging Management Programs and Activities, describes aging management programs and activities that will manage aging effects on components and structures within the scope of license renewal such that they will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. Appendix B contains a comparison of the PNPP programs to the programs evaluated in NUREG-1801. The information in Section 2, Section 3, and Appendix B fulfills the requirements of 10 CFR 54.21(a).

Appendix C is the site response to Boiling Water Reactor Vessel and Internals Project (BWRVIP) Applicant Action Items. License renewal applicant action items identified in the corresponding NRC safety evaluation for each of the reports listed are addressed in this appendix.

Appendix D, Technical Specification Changes, concludes that no technical specification changes are necessary to manage the effects of aging during the period of extended operation. The information in Appendix D fulfills the requirements in 10 CFR 54.22 to identify changes to Technical Specifications.

Appendix E, Applicant's Environmental Report – Operating License Renewal Stage, contains the environmental information which fulfills the requirements of 10 CFR 54.23 and 10 CFR 51.53(c).

ABBREVIATIONS AND ACRONYMS

The acronyms that are defined in this application are listed below, with their definitions:

Acronym	Definition
¼T	one-fourth of the way through the vessel wall measured from the internal surface of the vessel
ABN	absorb neutrons
ABVS	auxiliary building ventilation system
AC	alternating current
ACI	American Concrete Institute
ACSR	aluminum conductor steel reinforced
ADHR	alternate decay heat removal
ADS	automatic depressurization system
AEGTS	annulus exhaust gas treatment system
AEM	aging effect/mechanism
AFP	auditable file packages
AHU	air handling unit
ALARA	as low as (is) reasonably achievable
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
APRM	average power range monitor
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
B&PV	boiler and pressure vessel
BOP	balance of plant
BTP	Branch Technical Position
BWR	boiling water reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Program
CAS	central alarm station
CASS	cast austenitic stainless steel
CB&I	Chicago Bridge & Iron
CBF	cycle based fatigue

Acronym	Definition
CCGCS	containment combustible gas control system
CCW	component cooling water
CE	Conducts electricity
CEI	Cleveland Electric Illuminating (company)
CF	chemistry factor
CFR	Code of Federal Regulations
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CMTR	certified material test report
CO2	carbon dioxide
Corp.	corporation
CRD	control rod drive
CRDA	control rod drop accident
CRDRL	control rod drive return line
CSS	core support structure
CST	condensate storage tank
CTS	condensate transfer and storage
Cu	copper
CUF	cumulative usage factor
DC	direct current
DF	direct flow
DGBVS	diesel generator building ventilation system
DO	dissolved oxygen
DPA	displacement per atom
E&IC	electrical and instrumentation and controls
EAF	environmentally-assisted fatigue
ECC	emergency closed cooling
ECCS	emergency core cooling system
ECP	electrochemical corrosion potential
ECPCS	emergency closed cooling pump area cooling system
EFDS	equipment and floor drainage system
EFPY	effective full power years

Acronym	Definition
EN	enclosure (shelter or protection)
EOC	end of cycle
EOF	emergency operations facility
EPRI	Electric Power Research Institute
EQ	environmental qualification
ESF	engineered safety feature
ESW	emergency service water
ESWVS	emergency service water ventilation system
EXP	expansion (thermal, or seismic separation)
F (°F)	degrees Fahrenheit
FAC	flow-accelerated corrosion
FB	fire barrier
FCV	flow control valve
F_{en}	environmentally assisted fatigue correction factor
FENOC	FirstEnergy Nuclear Operating Company
FERC	Federal Energy Regulatory Commission
FHAES	fuel handing area exhaust subsystem
FHAR	fire hazards analysis report
FHASS	fuel handling area supply subsystem
FHAVS	fuel handling area ventilation system
FLB	flood barrier
FME	foreign material exclusion
FP	fire protection
FPCC	fuel pool cooling and cleanup
FPCCS	fuel pool cooling and cleanup system
ft-lb	foot-pound
FW	feedwater
FWLC	feedwater leakage control
GALL	Generic Aging Lessons Learned
GDC	general design criterion
GE	General Electric
GL	Generic Letter
GSI	generic safety issue

Acronym	Definition
H2	hydrogen
HAZ	heat-affected zone
HCU	hydraulic control unit
HDPE	high density polyethylene
HELB	high-energy line break
HEPA	high-efficiency particulate air
HPCS	high pressure core spray
HS	heat sink
HVAC	heating, ventilation, and air conditioning
HWC	hydrogen water chemistry
HWC with NMCA	hydrogen water chemistry with noble metal chemical application
HX	heat exchanger
Hz	hertz
I&C	Instrumentation and Controls
IASCC	irradiation-assisted stress corrosion cracking
ICM	integrated containment management
ID or I.D.	inside diameter
IEEE	Institute of Electronic and Electrical Engineers
IGSCC	inter-granular stress corrosion cracking
ILRT	integrated leak rate test
IN	Information Notice
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
IRM	intermediate range monitor
ISA	International Society of Automation
ISFSI	independent spent fuel storage installation
ISG	Interim Staff Guidance
ISI	inservice inspection
ISP	Integrated Surveillance Program
ksi	kilo-pounds per square inch
kV or KV	kilo-volt
LAS	low alloy steel

Acronym	Definition
LIP	local intense precipitation
LLC	limited liability company
LLRWSPF	low level radwaste storage and processing facility (one designation for the low level radwaste building)
LOCA	loss of coolant accident
LOOP	loss of offsite power
LPCI	low pressure coolant injection
LPCS	low pressure core spray
LPRM	local power range monitors
LR	license renewal
LRA	license renewal application
LR-ISG	Interim Staff Guidance Associated with License Renewal
LRW	liquid radioactive waste
LTOP	low-temperature overpressure protection
LWR	light water reactor
MB	missile barrier
MCC	motor control center
MgKOH	milligrams of potassium hydroxide
MeV	million electron-volts
MIC	microbiologically-influenced corrosion
MMS	mitigation monitoring system
MOV	motor operated valve
MSIP	Mechanical Stress Improvement Process
MSIV	main steam isolation valve
MSL	main steam line
MSR	moisture separator-reheater
mV	millivolt
MWe	megawatts-electrical
MWt	megawatts-thermal
N/A	not applicable
n/cm2	neutrons per square centimeter
NCC	nuclear closed cooling
NEI	Nuclear Energy Institute

Acronym	**Definition**
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
Ni	nickel
NMCA	noble metal chemical application
NPDES	National Pollution Discharge Elimination System
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NSAC	National Safety Analysis Center
NSSS	nuclear steam supply system
NUMARC	Nuclear Utility Management and Resources Council
NWC	no water chemistry
O2	oxygen
OCCWS	open cycle cooling water system
OD or O.D.	outside diameter
OE	operating experience
OLNC	on-line noble chemistry
OSSC	on-site storage container
p., pp.	page, pages
P&ID	piping and instrumentation diagram
PA	prompt alert / public address
PAF	primary access facility
PASS	post-accident sampling system
PB	pressure boundary
PEO	period of extended operation
pH	potential of hydrogen
PNPP	Perry Nuclear Power Plant
POF	probability of failure
ppb	parts per billion
ppm	parts per million
psig	pounds per square inch gauge
P-T	pressure-temperature
PTS	pressurized thermal shock

Acronym	Definition
PVC	polyvinyl chloride
PW	pipe whip (restraint)
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
Q	Quality
QAPM	Quality Assurance Program Manual
RAMA	Radiation Analysis Modeling Application
RCA	radiologically controlled area
RCIC	reactor core isolation cooling
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RG	Regulatory Guide
RHR	residual heat removal
RI-ISI	risk-informed inservice inspection
RP	release path
RPS	reactor protection system
RPV	reactor pressure vessel
RTNDT	reference temperature (nil-ductility transition)
RVI	Reactor Vessel Internals
RWCU	reactor water cleanup
Rx	reactor
RXV	reactor vessel
SAMA	severe accident mitigation alternatives
SAP	Systeme, Anwendungen und Produkte in der Datenverarbeitung [Systems, Applications and Products in Data Processing] – the plant component database
SBO	station blackout
SCBA	self-contained breathing apparatus
SCC	stress corrosion cracking
SCR	silicon controlled rectifier
SDV	scram discharge volume
SER	Safety Evaluation Report
SFDS	spent fuel dry storage
SHD	provide shielding against radiation

Acronym	Definition
SLC	standby liquid control
SLCS	standby liquid control system
SLO	single loop operation
SNS	support for non-safety affecting safety – Criterion (a)(2) equipment
SO2	sulfur dioxide
SOER	Significant Operating Experience Report
SPB	Structural pressure boundary
SPCU	suppression pool cleanup
SRE	support for regulated events – Criterion (a)(3) equipment
SRM	source range monitor
SRP	Standard Review Plan [NUREG-1800, License Renewal]
SRV	safety relief valve
SSC	system, structure, or component
SSE	safe shutdown earthquake
SSR	support for safety-related – Criterion (a)(1) equipment
STCS	steam tunnel cooling system
TAN	total acid number
TBCCW	turbine building closed cooling water
TBVS	turbine building ventilation system
TIP	traversing incore probe
TLAA	Time-Limited Aging Analysis
TMI	Three Mile Island
TPC	turbine power complex
TSC	technical support center
UFSAR	Updated Final Safety Analysis Report (same as USAR)
UPS	uninterruptible power source
USAR	Updated Safety Analysis Report (same as UFSAR)
USE	upper-shelf energy
USI	Unresolved Safety Issue
UT	Ultrasonic Testing
UTT	Ultrasonic thickness testing
VLI	valve lineup instruction
WANO	World Association of Nuclear Operators

Acronym	Definition
WARF RISB	waste abatement and reclamation facility/radwaste interim storage building (another designation for the low level radwaste building)
WLIN	water level instrumentation nozzle
Zn	zinc
ΔP	differential pressure
ΔRTNDT	shift in reference temperature for nil-ductility transition

Table of Contents

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Appendices

1.0 ADMINISTRATIVE INFORMATION

Pursuant to Part 54 of Title 10 of the Code of Federal Regulations (10 CFR 54) [Reference 1.3-1], this application seeks renewal for an additional 20-year term of the facility operating license for Perry Nuclear Power Plant, Unit 1 (PNPP). The current facility operating license (Docket No. 50-440, License Number NPF-58) expires at midnight on November 7, 2026. This application also seeks renewal of the source material, special nuclear material, and by-product material licenses under 10 CFR Parts 30, 40, and 70 that are subsumed in or combined with the facility operating license.

This application is organized in accordance with U.S. Nuclear Regulatory Commission Regulatory Guide 1.188, *Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses*, Revision 2 [Reference 1.3-2], and is consistent with guidance provided by Nuclear Energy Institute (NEI) 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule*, Revision 6 [Reference 1.3-3]. In addition, a summary of those Nuclear Regulatory Commission (NRC) License Renewal Interim Staff Guidance (LR-ISG) documents that remain open is presented in the application.

This application is intended to provide sufficient information for the NRC to complete its technical and environmental reviews pursuant to 10 CFR 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants* [Reference 1.3-1], and 10 CFR 51, *Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions* [Reference 1.3-4], respectively.

This application is designed to allow the NRC to make the findings required by 10 CFR 54.29, *Standards for Issuance of a Renewed License*, in support of the issuance of a renewed facility operating license for PNPP.

1.1 GENERAL INFORMATION

The following is the general information required by 10 CFR 54.17 and 10 CFR 54.19 [Reference 1.3-1].

Name of Applicant

Energy Harbor Nuclear Corp. (operator) is acting on its own behalf and for Energy Harbor Nuclear Generation LLC (Energy Harbor Corp.) (owner) by submitting this application. Energy Harbor Nuclear Corp. hereby applies for a renewed operating license for PNPP, Unit 1.

Address of Applicant

Energy Harbor Nuclear Corp. (operator)
168 E. Market Street
Akron, Ohio 44308

Energy Harbor Corp. (owner)
168 E. Market Street
Akron, Ohio 44308

1.1.1 NAMES OF APPLICANTS AND OWNER LICENSEES

Energy Harbor Nuclear Corp., acting on its own behalf and as agent for the owner licensee, submits this application to renew the operating license for PNPP.

Energy Harbor Nuclear Corp. is the operator-licensee for PNPP and has exclusive responsibility and control over the physical construction, operation, and maintenance of the facility. The owner is Energy Harbor Nuclear Generation LLC. Energy Harbor Nuclear Corp. and Energy Harbor Nuclear Generation LLC are owned by Energy Harbor Corp.

The PNPP operating license was transferred from FirstEnergy Nuclear Operating Company (FENOC) and FirstEnergy Nuclear Generation, LLC to Energy Harbor Nuclear Corp. and Energy Harbor Nuclear Generation LLC, respectively, in February 2020. Accordingly, this license renewal application includes reference documents that are directed to, or sourced from, FENOC. [1]

[1] Via Transmittal Letter L-23-095 dated April 14, 2023, Vistra Operations Company, on behalf of Energy Harbor Nuclear Corp. and Energy Harbor Nuclear Generation LLC, submitted an application for an order consenting to transfer of the PNPP operating license. Following approval of the Vistra request, the information in this section will be updated as part of the next annual update to this application.

1.1.2 ADDRESSES OF APPLICANTS AND OWNER LICENSEES

Energy Harbor Corp.
168 E. Market Street
Akron, OH 44308

Energy Harbor Nuclear Corp.
168 E. Market Street
Akron, OH 44308

Energy Harbor Nuclear Generation LLC
168 E. Market Street
Akron, OH 44308

Perry Nuclear Power Plant
10 Center Road
Perry, OH 44081

1.1.3 DESCRIPTION OF BUSINESS OF APPLICANT AND OWNER LICENSEES

Energy Harbor Nuclear Corp. is engaged in the business of operating nuclear generation facilities under the supervision and direction of the owners of the facilities.

Energy Harbor Nuclear Generation LLC owns nuclear generation assets and sells the output of those assets, including from PNPP, to Energy Harbor Corp. Energy Harbor Nuclear Corp. and Energy Harbor Nuclear Generation LLC are subsidiaries of Energy Harbor Corp.

1.1.4 ORGANIZATION AND MANAGEMENT OF APPLICANT AND OWNER LICENSEES

Energy Harbor Corp.

Energy Harbor Corp. is a Delaware Corporation public utility holding company. Energy Harbor Corp. is a privately-held entity. The principal office for Energy Harbor Corp. is in Akron, Ohio.

Energy Harbor Nuclear Corp.

Energy Harbor Nuclear Corp. is a wholly owned direct subsidiary of Energy Harbor Corp., a Delaware Corporation public utility holding company. The principal offices for Energy Harbor Nuclear Corp. are in Akron, Ohio. Energy Harbor Nuclear Corp. is qualified to do business in the states of Ohio and Pennsylvania.

Energy Harbor Nuclear Generation LLC

Energy Harbor Nuclear Generation LLC is a Delaware limited liability company, wholly owned by Energy Harbor Corp., and qualified to do business in the states of Ohio and

Pennsylvania. The Energy Harbor Nuclear Generation LLC principal offices are in Akron, Ohio.

Energy Harbor Corp., Energy Harbor Nuclear Corp. and Energy Harbor Nuclear Generation LLC, are not owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

The names and business addresses of the directors and principal officers of Energy Harbor Corp., Energy Harbor Nuclear Corp. and Energy Harbor Nuclear Generation LLC, are listed in the following tables. All persons are citizens of the United States.

Energy Harbor Corp.

Board of Directors & Officers

Name	**Address**
Board of Directors	
John Kiani Executive Chairman	168 E. Market Street Akron, OH 44308
John C. Blickle	168 E. Market Street Akron, OH 44308
Stephen E. Burnazian	168 E. Market Street Akron, OH 44308
Kevin T. Howell	168 E. Market Street Akron, OH 44308
Douglas G. Johnston	168 E. Market Street Akron, OH 44308
John W. Judge	168 E. Market Street Akron, OH 44308
Jennifer R. Kneale	168 E. Market Street Akron, OH 44308
John (Bill) W. Pitesa	168 E. Market Street Akron, OH 44308
Principal Officers	
John W. Judge President and Chief Executive Officer	168 E. Market Street Akron, OH 44308
Stephen E. Burnazian Executive Vice President, Chief Commercial Officer, Chief Strategy Officer, and Corporate Secretary	168 E. Market Street Akron, OH 44308
David B. Hamilton Executive Vice President, Chief Operating Officer, and Chief Nuclear Officer	168 E. Market Street Akron, OH 44308
David L. Griffing Executive Vice President, Government Affairs	168 E. Market Street Akron, OH 44308
Jason S. Petrik Executive Vice President, Chief Financial Officer, and Chief Risk Officer	168 E. Market Street Akron, OH 44308
Tanya Rohauer Senior Vice President, Commercial Finance & Treasurer	168 E. Market Street Akron, OH 44308
Rick C. Giannantonio Executive Vice President and General Counsel	168 E. Market Street Akron, OH 44308
Jay K. Bellingham Senior Vice President, Fossil	168 E. Market Street Akron, OH 44308

Energy Harbor Nuclear Corp.

Directors and Principal Officers

Name & Title	Address
Managers	
Stephen E. Burnazian	168 E. Market Street Akron, OH 44308
David B. Hamilton	168 E. Market Street Akron, OH 44308
John W. Judge	168 E. Market Street Akron, OH 44308
Principal Officers	
David B. Hamilton President and Chief Nuclear Officer	168 E. Market Street Akron, OH 44308
Jason S. Petrik Executive Vice President, Chief Financial Officer, Chief Risk Officer	168 E. Market Street Akron, OH 44308
David L. Griffing Executive Vice President, Government Affairs	168 E. Market Street Akron, OH 44308
Darin M. Benyak Senior Vice President, Fleet Nuclear Operations	168 E. Market Street Akron, OH 44308
Terry J. Brown Vice President, Davis-Besse	168 E. Market Street Akron, OH 44308
Barry N. Blair Vice President, Beaver Valley	168 E. Market Street Akron, OH 44308
Rod L. Penfield Vice President, Perry	168 E. Market Street Akron, OH 44308
Stephen E. Burnazian Corporate Secretary	168 E. Market Street Akron, OH 44308
Tanya Rohauer Treasurer	168 E. Market Street Akron, OH 44308
Christopher J. Jackson General Plant Manager, Davis-Besse	168 E. Market Street Akron, OH 44308
Robert J. Kristophel General Plant Manager, Beaver Valley	168 E. Market Street Akron, OH 44308
Christopher M. Elliott General Plant Manager, Perry	168 E. Market Street Akron, OH 44308

Energy Harbor Nuclear Generation LLC

Principal Officers

Name	Address
Managers	
Stephen E. Burnazian	168 E. Market Street Akron, OH 44308
David B. Hamilton	168 E. Market Street Akron, OH 44308
John W. Judge	168 E. Market Street Akron, OH 44308
Principal Officers	
David B. Hamilton President and Chief Nuclear Officer	168 E. Market Street Akron, OH 44308
Jason S. Petrik Corporate Secretary, Chief Financial Officer, Chief Risk Officer	168 E. Market Street Akron, OH 44308
Darin M. Benyak Senior Vice President, Fleet Nuclear Operations	168 E. Market Street Akron, OH 44308
Stephen E. Burnazian Corporate Secretary	168 E. Market Street Akron, OH 44308
Tanya Rohauer Treasurer	168 E. Market Street Akron, OH 44308

1.1.5 CLASS AND PERIOD OF LICENSE SOUGHT

Energy Harbor Nuclear Corp. requests renewal of the Class 103 facility operating license for PNPP, Unit 1 (facility operating license NPF-58) for a period of 20 years beyond the expiration of the current license term. License renewal would extend the facility operating license from midnight, November 7, 2026, to midnight, November 7, 2046. The facility would continue to be known as Perry Nuclear Power Plant, Unit 1, and would continue to generate electric power during the period of extended operation.

This application also includes a request for renewal of the source material, special nuclear material, and by-product material licenses under 10 CFR Parts 30, 40, and 70 that are subsumed in or combined with the current facility operating license.

1.1.6 ALTERATION SCHEDULE

Energy Harbor Nuclear Corp. does not propose to construct or alter any production or utilization facility in connection with this renewal application. No physical plant alterations or modifications have been identified as necessary in order to implement the provisions of the LRA. The current licensing basis (CLB) will be continued and maintained throughout the period of extended operation (PEO).

1.1.7 REGULATORY AGENCIES HAVING JURISDICTION

Regulatory agencies with jurisdiction over PNPP rates and services are as follows:

Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Public Utilities Commission of Ohio
180 East Broad Street
Columbus, OH 43215

1.1.8 LOCAL NEWS PUBLICATIONS

The news and trade publications which circulate in the area surrounding PNPP, and which are considered appropriate to give reasonable notice of the renewal application to those municipalities, private utilities, public bodies, and cooperatives that might have a potential interest in the facility, are listed below.

Newsroom
The Plain Dealer
4800 Tiedeman Road
Brooklyn, OH 44144

Newsroom
Akron Beacon Journal
388 S. Main Street
Akron, OH 44309

Newsroom
The Star Beacon
4626 Park Avenue
Ashtabula, OH 44004

Newsroom
The News-Herald
7085 Mentor Avenue
Willoughby, OH 44094

1.1.9 CONFORMING CHANGES TO THE STANDARD INDEMNITY AGREEMENT

10 CFR 54.19(b) [Reference 1.3-1] requires that license renewal applications include "…conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B [Reference 1.3-5], to account for the expiration term of the proposed renewed license." The current Indemnity Agreement (No. B-98) for Perry Nuclear Power Plant, Unit 1, in Article VII, states that the agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment (to the agreement). Item 3 of the Attachment to the indemnity agreement, as revised by Amendment Nos. 1 and 2, lists PNPP facility operating license number NPF-58. Energy Harbor has reviewed the original indemnity agreement and Amendments 1 through 7. Neither Article VII nor Item 3 of the attachment specifies an expiration date for license number NPF-58. Therefore, no changes to the indemnity agreement are deemed necessary as part of this application. Should the license number be changed by NRC upon issuance of the renewed license, Energy Harbor requests that NRC amend the indemnity agreement to include conforming changes to Item 3 of the attachment and other affected sections of the agreement.

1.1.10 RESTRICTED DATA AGREEMENT

This application does not contain restricted data or national security information, and Energy Harbor does not expect that any activity under the renewed license for PNPP will involve such information. However, if such information were to become involved, Energy Harbor agrees that it will appropriately safeguard such information and not permit any individual to have access to, or any facility to possess, such information until the individual or facility has been approved under the provisions of 10 CFR 25, *Access Authorization*, or 10 CFR 95, *Facility Security Clearance and Safeguarding of National Security Information and Restricted Data*.

1.1.11 REFERENCED INFORMATION

Under the provision of 10 CFR 54.17(e) [Reference 1.3-1] this application incorporates by reference information contained in previous applications for licenses or license amendments, statements, correspondence, or reports filed with the Commission, based on clear and specific references.

1.2 DESCRIPTION OF PERRY NUCLEAR POWER PLANT

The plant site is located along the southeastern shoreline of Lake Erie on an ancient lake plain approximately 50 feet above lake low water datum. It is approximately 1,030 acres in size and relatively flat. The land has a very gentle slope toward the lake and is incised by small streams which drain into the lake. Located in a rural area of Lake County, Ohio, the site is approximately seven miles northeast of Painesville, the county seat, and 35 miles northeast of Cleveland, the nearest large principal city. The eastern two thirds of the site are within the boundaries of North Perry Village while the western third is within Perry Township. Lake Erie borders the site to the north.

Two nuclear units were planned for the site. Unit 1 construction was completed, and the unit received its full power operating license in November 1986. Unit 2 construction had achieved substantial progress when, in August 1994, the Cleveland Electric Illuminating Company notified the NRC of the intent to permanently terminate construction activities for PNPP Unit 2. Some of the systems and structures that were originally to be shared by both units or intended for Unit 2 are now used to support the operation of Unit 1 (see discussion in LRA Section 2.1.1.4).

The plant has a boiling water reactor nuclear steam supply system as designed and supplied by the General Electric Company and designated BWR/6, with a Mark III containment. The rated core thermal power of the unit is 3,758 MWt. The net electrical output is 1,277 MWe and the gross electrical output is 1,327.6 MWe. These values reflect implementation of one five-percent power uprate, implemented in 2000 following NRC approval of License Amendment 112 to Operating License NPF-58. License Amendment 112 increased rated thermal power from 3,579 MWt to 3,758 MWt. The plant, including the reactor containment, was designed by Gilbert Associates, Inc., Reading, Pennsylvania, as architect-engineer and agent for the applicant.

As identified in the Updated Final Safety Analysis Report (UFSAR) [Reference 1.3-6], the Unit 1 power generation complex (power block) includes the following structures: Reactor Building, Service Building, Turbine Building, Turbine Power Complex, Auxiliary Building, Water Treatment Building, Diesel Generator Building, Radwaste Building, Fuel Handling Building, Auxiliary Boiler Building, Control Complex, Intermediate Building, and Offgas Building. Beyond the power block other structures include the Cooling Tower, Service Water Pumphouse, Emergency Service Water Pumphouse, Circulating Water Pumphouse, Independent Spent Fuel Storage Installation (ISFSI), Meteorological Tower, Low Level Radwaste Building, Fuel Oil Storage Tank and Pumphouse, Condensate Storage Tank, Hydrogen Storage Tanks, Station Switchyard, Primary Access Facility, and Training Center.

Descriptions of many of the PNPP systems and structures can be found in the USAR. Additional descriptive information about the PNPP systems and structures is provided in Section 2 of this application.

1.3 GENERAL REFERENCES

1.3-1 10 CFR 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants*

1.3-2 Regulatory Guide 1.188, *Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses*, U.S. Nuclear Regulatory Commission, Revision 2

1.3-3 NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule*, Nuclear Energy Institute, Revision 6

1.3-4 10 CFR 51, *Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*

1.3-5 10 CFR 140.92, Appendix B – *Form of Indemnity Agreement with Licensees Furnishing Insurance Policies as Proof of Financial Protection*

1.3-6 *Updated Safety Analysis Report (USAR, referred to as UFSAR throughout this application)*, Energy Harbor Nuclear Corp., Revision 22

1.3-7 10 CFR 50, *Domestic Licensing of Production and Utilization Facilities*

1.3-8 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Volumes 1 and 2, U.S. Nuclear Regulatory Commission, Revision 2

1.3-9 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,* U.S. Nuclear Regulatory Commission, Revision 2

1.3-10 Correspondence Letter, Bhalchandra K. Vaidya (Nuclear Regulatory Commission) to David B. Hamilton (Energy Harbor Nuclear Corp.), Dated February 27, 2020, Subject: "Beaver Valley Power Station, Unit Nos. 1 and 2; Davis-Besse Nuclear Power Station, Unit No. 1; and Perry Nuclear Power Plant, Unit No. 1 – Issuance of Amendments Nos. 304, 194, 299, and 187, Respectively, RE: Order Approving Transfer of License and Conforming License Amendments (EPID L-2020-LLM-0000)" (ADAMS ML20030A440)

1.3-11 Facility Operating License No. NPF-58, Perry Nuclear Power Plant, Unit No. 1, through Amendment No. 187

1.3-12 FENOC Correspondence Letter L-19-073, Dated April 26, 2019, Subject: "Application for Order Consenting to Transfer of Licenses and Conforming License Amendments" (ADAMS ML19116A087)

1.3-13 EPRI *License Renewal Electrical Handbook* (EPRI Report 1013475)

1.3-14 NUREG-0933, *Resolution of Generic Safety Issues*, December 2011

1.3-15 10 CFR 100, "Reactor Site Criteria"

1.3-16 NUREG-2191, *Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report*, U.S. Nuclear Regulatory Commission, July 2017

1.3-17 NUREG-2192, *Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants*, U.S. Nuclear Regulatory Commission, July 2017

1.3-18 ACI-318-71, *Building Code Requirements for Reinforced Concrete*, American Concrete Institute, 1971

2.0 SCOPING AND SCREENING METHODOLOGY FOR IDENTIFYING STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW AND IMPLEMENTATION RESULTS

This section describes the process for identification of structures and components subject to aging management review (AMR) in the PNPP integrated plant assessment (IPA). For the systems, structures, and components (SSCs) within the scope of license renewal, 10 CFR 54.21(a)(1) [Reference 1.3-1] requires the license renewal applicant to identify and list structures and components subject to AMR. Furthermore, 10 CFR 54.21(a)(2) requires that the methods used to identify these structures and components be described and justified. Information in this section satisfies these requirements.

The scoping and screening method is described in Section 2.1. This method is implemented in accordance with NEI 95-10, *Industry Guidelines for Implementing the Requirements of 10 CFR 54 - The License Renewal Rule*, Revision 6, June 2005 [Reference 1.3-3]. The results of the assessment to identify the systems and structures within the scope of license renewal (plant level scoping) are in Section 2.2. The results of the identification of the long-lived, passive mechanical, structural and electrical components subject to AMR (screening) are in Section 2.3 for mechanical systems, Section 2.4 for structures, and Section 2.5 for electrical and I&C systems.

Table 2.3-1 provides the definitions of component intended functions used in this application for mechanical components.

Table 2.4-1 provides a list of the abbreviations and definitions for the intended functions used in this application for structural components.

Table 2.5-1 provides the definitions of component intended functions used in this application for electrical components.

2.1 SCOPING AND SCREENING METHODOLOGY

The PNPP systems, structures and components (SSCs) scoping and screening approach, process, documents reviewed, and conclusions are described in the following sections:

- Scoping Methodology (Section 2.1.1)
- Screening Methodology (Section 2.1.2)
- Interim Staff Guidance Discussion (Section 2.1.3)
- Generic Safety Issues (Section 2.1.4)
- Conclusion (Section 2.1.5)

2.1.1 SCOPING METHODOLOGY

The License Renewal Rule (10 CFR 54), *Requirements for Renewal of Operating Licenses for Nuclear Power Plants* [Reference 1.3-1], defines the scope of License Renewal.

10 CFR 54.4(a) requires systems, structures, and components (SSCs) to be included in the license renewal process if they are:

(1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions:

(i) The integrity of the reactor coolant pressure boundary;

(ii) The capability to shutdown the reactor and maintain it in a safe shutdown condition; or,

(iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in §50.34(a)(1), §50.67(b)(2), or §100.11 of this chapter, as applicable.

(2) All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this Section (i.e., §54.4).

(3) All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule, Revision 6* [Reference 1.3-3], provides industry guidance for determining which SSCs are within the scope of license renewal. Regulatory Guide 1.188, *Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses*, Revision 2 [Reference 1.3-2], continues to endorse Revision 6 of NEI 95-10 as acceptable for complying with the requirements of 10 CFR Part 54 for preparing an initial LRA. PNPP followed the process and recommendations of NEI 95-10, Revision 6, to determine which SSCs are within the scope of license renewal.

Structural components included in mechanical systems, such as pipe supports and insulation, are evaluated as structural elements and bulk commodities. If a component or parts of it carry electrical current, it is electrical; if it supports, protects or restrains the movement of a component, it is civil/structural; everything else is considered to be mechanical.

A more detailed description of the evaluation process using the criteria of 10 CFR 54.4 [Reference 1.3-1] is described in the following sections. Section 2.1.1.1 discusses the evaluation against the safety-related criterion in 10 CFR 54.4(a)(1). Section 2.1.1.2 discusses the evaluation of nonsafety-related SSCs against the criterion of 10 CFR 54.4(a)(2). Section 2.1.1.3 discusses the evaluation against the regulated events criterion, 10 CFR 54.4(a)(3). The results of these evaluations for plant systems are presented in Section 2.2.

Mechanical

Consistent with NEI 95-10, the PNPP scoping process developed a list of plant mechanical systems and their functions, and then determined which of those functions met any of the three criteria of 10 CFR 54.4(a). Intended functions are the basis for including a system within the scope of license renewal and are identified by comparing the system function with the criteria in 10 CFR 54.4(a).

Systems-Applications-Products (SAP) is the software platform for the PNPP configuration management database. Within that database, component data is organized according to functional locations, hereafter referred to as the SAP functional location database. Components in the database have unique identifiers that include a system label. Thus, the database is used as a starting point to develop a list of plant systems. The database system list was then compared to other current licensing basis (CLB) documentation, including the UFSAR [Reference 1.3-6], Maintenance Rule System Basis Documents and plant drawings. Systems which contain mechanical components were evaluated as mechanical systems. In some cases, closely related systems were combined in this LRA for ease of review.

Structural

Consistent with NEI 95-10, the PNPP scoping process developed a list of plant structures and their functions, and then determines which of those functions meet any of the three criteria of 10 CFR 54.4(a). Intended functions are the basis for including a structure within the scope of license renewal and are identified by comparing the structure function with the criteria in 10 CFR 54.4(a).

Structural components included in mechanical systems, such as pipe supports and insulation, are evaluated as structural elements and bulk commodities.

Structural scoping is performed based on identification of functions for structures and structural commodities. That approach bounds components grouped as structural systems and obviates the need for system-level structural scoping.

Functions for structures were identified based on reviews of applicable plant licensing and design documentation. Documents used in the reviews included the UFSAR, quality categorization within the SAP functional location database, Technical Specifications, the Appendix R Safe Shutdown Capability Report, the Fire Protection Evaluation Report (UFSAR Chapter 9 Appendix A), Maintenance Rule basis documents, engineering calculations, operating procedures, various station drawings, and other license basis documentation such as licensing letters and Safety Evaluation Reports, as necessary. A list of structures within the scope of license renewal is found in Table 2.2-2. The list includes structures that potentially support plant operations or that could adversely impact structures that support plant operations (e.g., seismic II over I). In addition to buildings and facilities, the list of structures includes other structures that support plant operation (e.g., electrical manholes and foundations for freestanding tanks).

Electrical

Three scoping methodologies are described in the EPRI License Renewal Electrical Handbook (EPRI Report 1013475) [Reference 1.3-13]; each methodology describes an approach to determining which electrical and I&C components and commodities at the plant meets the criteria of 10 CFR 54.4. PNPP has chosen Method A, the System Level or In-Scope Bounding Approach.

Using Method A, all plant electrical and I&C (EIC) systems are included in the scope of license renewal. All EIC components in mechanical systems are also included but these systems are not listed separately. Including systems and components beyond those actually required by 10 CFR 54.4 is referred to as an encompassing or bounding review. In addition to the plant EIC systems, certain offsite power systems and components are included in scope based on NRC guidance.

The SAP functional location database includes systems that are categorized as EIC instead of mechanical, based on their predominant function. Those EIC systems are listed in Table 2.2-3. Because of the method used to perform EIC scoping for license renewal, EIC system intended functions were not evaluated for each system during the scoping process.

When used with the plant spaces approach, this scoping method eliminates the need for unique identification of each EIC component and its specific location. The method allows commodity groups, systems or spaces to be eliminated during further review as their intended functions are examined.

Additional details on electrical and I&C system scoping are provided in Section 2.2.

2.1.1.1 Application of Safety-Related Scoping Criteria

A system, structure, component, or bulk commodity is within the scope of license renewal if it is relied upon to remain functional during and following a design basis event as stated in 10 CFR 54.4(a)(1) [Reference 1.3-1]. Design basis events are defined in 10 CFR 50.49(b)(1)(ii) [Reference 1.3-7], as conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to ensure functions identified in 10 CFR 54.4(a)(1)(i) through (iii). The design basis events include the design basis accidents described in Chapter 15 of the UFSAR and events described in other parts of the licensing basis documentation, such as floods, fires, tornados, seismic events, and moderate and high energy line breaks.

The PNPP UFSAR [Reference 1.3-6], Section 3.2.1, specifies:

Plant structures, systems and components important to safety are designed to withstand the effects of a Safe Shutdown Earthquake (SSE) and remain functional if they are necessary to assure:

a. The integrity of the reactor coolant pressure boundary,
b. The capability to shut down the reactor and maintain it in a safe condition, or
c. The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures of <10 CFR 100> or <10 CFR 50.67> (future revisions to design basis analyses that compare consequences to 10 CFR 100 will be updated to <10 CFR 50.67>) [References 1.3-7 and 1.3-15].

This definition is similar to that used for safety-related SSCs in 10 CFR 54.4(a)(1) but excludes reference to offsite exposures referenced in 10 CFR 50.34(a)(1). Section 10 CFR 50.34(a)(1) is applicable to facilities seeking a construction permit and is therefore not applicable to renewal of the existing Facility Operating License at PNPP.

Component quality (safety) classification is maintained as a controlled field in the SAP functional location database.

Systems that rely on mechanical components to perform a safety function, and structures and structural components that perform a safety function are included in the scope of license renewal. Mechanical system and structural safety functions were determined by review of the following plant-specific references:

- UFSAR
- Quality classification (Q-list – contained within the SAP functional location database)
- Technical Specifications
- Maintenance Rule basis documents
- Engineering calculations
- Operating procedures
- Station drawings
- Other license basis documentation such as licensing letters and Safety Evaluation Reports

2.1.1.2 APPLICATION OF CRITERION FOR NONSAFETY-RELATED SSCS WHOSE FAILURE COULD PREVENT THE ACCOMPLISHMENT OF SAFETY FUNCTIONS

PNPP contains nonsafety-related mechanical systems (and portions of systems) and structures (and parts of structures) whose failure could prevent satisfactory accomplishment of a safety function. The method used to identify these components is consistent with Appendix F of NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule*, [Reference 1.3-3]. Consideration of hypothetical failures that could result from system or structure interdependencies that are not part of the current licensing basis and that have not been previously experienced is not required.

The impact of nonsafety-related SSC failures on safety functions can be either functional or spatial. In a functional failure, the failure of a nonsafety-related SSC to perform its normal function impacts a safety function. In a spatial failure, the loss of structural or mechanical integrity of a nonsafety-related SSC attached to, or in physical proximity to a safety-related component impacts a safety function of the safety-related component.

2.1.1.2.1 Functional Failures of Nonsafety-Related SSCs

At PNPP, systems and structures required to perform a function to support a safety function are generally classified as safety-related and are included in the scope of license renewal per Section 2.1.1.1. For the exceptions where nonsafety-related equipment and structures are required to remain functional to support a safety function, the function is listed as an intended function for 10 CFR 54.4(a)(2) [Reference 1.3-1], and the system or part of the structure containing the equipment is included in scope.

Systems that rely on nonsafety-related mechanical components to support a safety function are included in the scope of license renewal. Mechanical systems with nonsafety-related components that support safety-related functions were determined by review of the following PNPP documents:

- UFSAR [Reference 1.3-6]
- Q list (contained within the SAP functional location database)
- Maintenance Rule basis documents
- Engineering calculations
- Operating procedures
- Station drawings
- Other license basis documentation such as licensing letters and Safety Evaluation Reports

2.1.1.2.2 Spatial Failures of Nonsafety-Related SSCs

Systems, structures and components meeting the scoping criterion of 10 CFR 54.4(a)(2) [Reference 1.3-1] due to spatial failures fit into one of the following categories:

- Nonsafety-related SSCs directly connected to safety-related SSCs; or,
- Nonsafety-related SSCs that are not directly connected to safety-related SSCs but have the potential for spatial interaction (such as Seismic II over I).

Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs

For nonsafety-related SSCs directly connected to safety-related SSCs the connected piping and supports up to and including the first seismic or equivalent anchor beyond the safety-nonsafety interface are within the scope of license renewal if the nonsafety-related piping may provide structural support to the safety-related piping. For the purposes of License Renewal scoping, an equivalent anchor is defined as a seismic anchor or group of supports that provide lateral and torsional restraint in three orthogonal directions. An alternative to specifically identifying a seismic or equivalent anchor is to include enough of the nonsafety-related piping run to ensure that these anchors are included and thereby ensure the piping and anchor intended functions are maintained. NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule* [Reference 1.3-3], Appendix F, Part 4, describes acceptable alternative methods of establishing the scope of nonsafety-related SSCs directly connected to safety-related SSCs. Additionally, nonsafety-related portions of safety-related piping systems downstream of the first anchor are in scope if they have the potential for spatial interaction with safety-related SSCs, as described below.

Systems containing components that perform this function were identified by review of station drawings. Other documents referenced included piping seismic/stress analyses. All piping system transitions from safety-related to nonsafety-related were evaluated to ensure that scoping for this criterion is consistent with the guidance of NEI 95-10 [Reference 1.3-3].

For nonsafety-related structures directly connected to safety-related structures or components, the entire connected structure, or a part of the connected structure up to a designated boundary, will be included within the scope of license renewal. NEI 95-10, Appendix F [Reference 1.3-3], describes acceptable methods of establishing the scope of nonsafety-related structures directly connected to safety-related structures or components.

Nonsafety-Related SSCs Not Directly Connected to Safety-Related SSCs with the Potential for Spatial Interaction

Protective features (whip restraints, spray shields, supports, barriers, temporary flood barriers, etc.) may be installed to protect safety-related SSCs from spatial interaction with nonsafety-related SSCs. Such protective features credited in the plant design are within the scope of license renewal per 10 CFR 54.4(a)(2) [Reference 1.3-1]. Where those features provide adequate protection, the nonsafety-related SSC itself is excluded from the scope of license renewal. The protective features are typically associated with a structural element such as a wall and are included in structural scoping.

The following sections address the different modes of spatial interaction with nonsafety-related SSCs that were considered. Interactions can occur in the following ways:

- Physical impact such as in a seismic event;
- Damage due to leakage, spray, or flooding; and,
- Pipe whip, jet impingement, or harsh environment resulting from a piping rupture.

Physical Impact

This category concerns the potential spatial interaction of nonsafety-related SSCs falling on or otherwise physically impacting safety-related SSCs such that safety functions may not be accomplished.

Nonsafety-related cable trays and conduits are examples of structural commodities that could potentially impact safety-related SSCs.

All nonsafety supports for piping, or supports for long term shielding or scaffolding, with a potential for spatial interaction with safety-related SSCs are within the scope of license renewal per 10 CFR 54.4(a)(2).

NEI 95-10, Appendix F [Reference 1.3-3], confirms that, if the effects of aging on the supports for these piping systems are managed, falling of piping sections is not considered credible, and does not need to be considered. The affected piping section itself is not in scope for 10 CFR 54.4(a)(2) due to the physical impact hazard. The effects of spray and leakage were also considered, as discussed below.

Missiles can be generated from internal or external events, such as failure of rotating equipment. Structures or structural features (e.g., missile barriers) that protect safety-related equipment from missiles are within the scope of license renewal per 10 CFR 54.4(a)(2) [Reference 1.3-1].

Overhead load-handling systems from which a dropped load could result in damage to any system that could prevent the accomplishment of a safety-related function are within the scope of license renewal per 10 CFR 54.4(a)(2) [Reference 1.3-1].

Leakage, Spray, or Flooding

Moderate- and low-energy systems, as well as high-energy systems, have the potential for spatial interactions of spray and leakage. Nonsafety-related systems, and nonsafety-related portions of safety-related systems with the potential for spray or leakage that could prevent safety-related SSCs from performing their required safety function are within the scope of license renewal per 10 CFR 54.4(a)(2) [Reference 1.3-1].

Air and gas (nonliquid, non-steam) systems are not a hazard to other plant equipment. Components that do not contain liquids or steam cannot adversely affect safety-related SSCs due to leakage or spray. Operating experience indicates that nonsafety-related systems containing only air or gas have experienced no failures due to aging that could impact the ability of safety-related equipment to perform required safety functions.

There are no credible aging effects for these systems when the environment is a dry gas. Therefore, these systems are not within the scope of license renewal per 10 CFR 54.4(a)(2) based on the potential for spray or leakage.

Nonsafety-related systems and nonsafety-related portions of safety-related systems containing steam or liquid that are near safety-related equipment are within the scope of license renewal per 10 CFR 54.4(a)(2) (including oil within components that have an oil system that includes an oil pump and piping). Failures of nonsafety-related components may result in spray or leakage onto safety-related equipment.

The review utilized a spaces approach for scoping of nonsafety-related systems (or portions of systems) that have a potential for spatial interaction with safety-related SSCs. A “space” is defined as a room or cubicle that is separated from other spaces by substantial objects (such as wall, floors, and ceilings). The space is defined such that any potential interaction between nonsafety-related and safety-related SSCs, including flooding and harsh environments, is limited to the space. This normally results in the entire safety-related structure being considered as a single space, with all nonsafety-related steam- or liquid-retaining components in the structure being within scope.

Structures and structural elements and commodities have potential for leakage or flooding including earthen structures (major stream, remnant minor stream and the diversion stream) that could prevent safety-related SSCs from performing their required safety function are within the scope of license renewal per 10 CFR 54.4(a)(2). Nonsafety-related walls, curbs, dikes, doors, temporary flood barriers, storm drains, etc., that provide flood barriers for safety-related SSCs are within the scope of license renewal per 10 CFR 54.4(a)(2).

The following structures (spaces) contain safety-related components with the potential for spatial interactions with nonsafety-related components:

- Auxiliary Building
- Condensate Storage Tank Dike
- Control Complex
- Diesel Generator Building
- Emergency Service Water Pump House
- Fuel Handling Building
- Intermediate Building
- Offgas Building
- Reactor Building
- Service Water Valve Pit

Note that the RadWaste Building is classified as safety-related but contains no safety-related mechanical components. However, there are three safety-related conduits at elevation 621 feet (approximately) in the Radwaste Building. The conduits support and protect electrical cables between the Control Complex on the south and an underground duct bank at the north wall of the Radwaste Building. These conduits provide protection of the enclosed cables from spatial interactions with moderate energy piping such as spray or leakage. There are no high energy lines whose failure could result in adverse spatial interactions in the Radwaste Building. Because these safety-related cables are protected by conduit, mechanical components in the Radwaste Building do not have the potential for spatial interactions that could result in the loss of a function identified in 10 CFR 54.4(a)(1).

The Unit 2 Reactor Building forms part of the south wall of the safety-related Intermediate and Fuel Handling Buildings. The Unit 2 Containment Vessel acts as a piping anchor for several in-scope piping systems.

Additionally, some components are conservatively classified as “Q” in the SAP functional location database but are not located within the structures listed above. Evaluations conclude that failure of these components will not result in a loss of a safety-related function, and as such, nonsafety-related components in the same structures are not included within scope for spatial considerations. The scope of these components (including associated panels, supports and cabling) is:

- Reactor protection, rod control and information system instrumentation associated with the turbine and condenser;
- Main steam leak detection temperature instrumentation; and,
- Post-accident high range radiation monitors.

Systems containing nonsafety-related components within safety-related structures were primarily identified by review of station drawings (P&IDs and isometric/piping location drawings). For cases in which component building locations could not be determined by drawing review, other documentation was reviewed to establish component location, or walkdowns were performed. Plant operating procedure valve lineup instructions (VLIs) identify valve locations.

Pipe Whip, Jet Impingement, or Harsh Environments

Pipe whip, jet impingement, and harsh environment effects on safety-related equipment are addressed in site-specific analyses of high- and moderate-energy line breaks. Spatial interactions of pipe whip, jet impingement, and harsh environment are credible only for high-energy systems. The effects of spray, leakage and flooding were also considered, as discussed above, such that high energy lines within safety-related structures are included within scope. As such, scoping of nonsafety-related systems and components due to the potential for high- and moderate-energy line breaks can be limited to those systems (or portions of systems) that are not already in scope due to the spray and leakage consideration. Categorically, scoping of nonsafety-related structures and commodities due to the potential for high- and moderate-energy line breaks can be limited to those structures (or portions of structures) that are not already in scope due to leakage or flooding considerations.

If a high-energy line break (HELB) analysis assumes that a nonsafety-related piping system does not fail, or assumes failure only at specific locations, then that piping system is within the scope of license renewal per 10 CFR 54.4(a)(2) and is subject to aging management review to provide reasonable assurance that those assumptions remain valid throughout the period of extended operation.

2.1.1.3 Application of Criterion for Regulated Events

The scope of license renewal includes SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for any of the following regulated events:

- Fire protection (FP) (10 CFR 50.48),
- Environmental qualification (EQ) (10 CFR 50.49),
- Pressurized thermal shock (PTS) (10 CFR 50.61),
- Anticipated transient without scram (ATWS) (10 CFR 50.62), and
- Station blackout (SBO) (10 CFR 50.63).

This Section discusses the approach used to identify the systems and structures within the scope of license renewal based on this criterion.

2.1.1.3.1 Fire Protection (10 CFR 50.48)

Systems and structures in the scope of license renewal for fire protection include those required for compliance with 10 CFR 50.48 [Reference 1.3-7]. The fire protection program has been developed to satisfy the requirements of 10 CFR 50 and Branch Technical Position BTP APCSB 9.5-1, Appendix A, and to meet the intent of 10 CFR 50 Appendix R. Equipment relied on for fire protection includes SSCs credited with fire prevention, detection, and mitigation in areas containing equipment important to safe operation of the plant as well as systems that contain plant components credited for safe shutdown following a fire. To identify this equipment, PNPP fire protection licensing basis documents were reviewed. The primary reference for this scoping criterion is the Appendix R Safe Shutdown Capability Report. Other documents reviewed included:

- UFSAR [Reference 1.3-6] Section 9.5.1 (Fire Protection description);
- UFSAR Appendix 9A (Fire Protection Evaluation Report);
- Fire Protection Program procedure;
- Quality classification, Notes and Comments fields of the SAP functional location database; and,
- Station drawings.

The Appendix R Safe Shutdown Capabilities Report describes the PNPP strategy and analysis that assures safe shutdown of the plant in the event of a fire, in accordance with 10 CFR 50, Appendix R.

UFSAR 9.5.1 describes the prevention, detection and suppression design features of plant SSCs.

UFSAR Appendix 9A includes the fire hazards analysis and description of systems for safe shutdown.

The Fire Protection Program procedure provides the administrative guidance for functional requirements of fire rated assemblies and barriers, and for detection and suppression subsystems.

The SAP functional location database quality classification field is a controlled field that can be used to aid in the identification of nonsafety-related components credited with a fire protection function. Most of these components are listed with an augmented ("A") quality field assignment. The database also contains amplifying information in a Notes and Comments section on whether specific components support Fire Protection Program requirements.

Station drawings provide information identifying the scope of fire suppression piping components credited for fire protection.

Based on the PNPP current licensing bases for fire protection, system and structure intended functions performed in support of 10 CFR 50.48 requirements were determined. The results of this determination are provided for mechanical systems in Section 2.3, and in Section 2.4 for structures and structural elements.

2.1.1.3.2 Environmental Qualification (10 CFR 50.49)

10 CFR 50.49 [Reference 1.3-7], defines electric equipment important to safety that is required to be environmentally qualified to mitigate certain accidents that would result in harsh environmental conditions in the plant. The PNPP Environmental Qualification (EQ) Program, which satisfies these requirements, controls the maintenance of the list of EQ components. The SAP functional location database contains a controlled field that identifies components within the EQ program.

The scope of 10 CFR 50.49 does not include electric equipment important to safety located in a mild environment. A mild environment is an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences. This regulation does not apply to structures because structures are not electric equipment.

2.1.1.3.3 Pressurized Thermal Shock (10 CFR 50.61)

10 CFR 50.61 [Reference 1.3-7], requires that licensees of pressurized water reactors (PWRs) evaluate the reactor vessel beltline materials against specific criteria to ensure protection from brittle fracture. As a boiling water reactor (BWR), PNPP is not subject to this regulation.

2.1.1.3.4 Anticipated Transients without Scram (10 CFR 50.62)

An anticipated transient without scram (ATWS) is an anticipated operational occurrence that is accompanied by a failure of the reactor trip function to shut down the reactor.

The ATWS rule, 10 CFR 50.62 [Reference 1.3-7], requires specific improvements in the design and operation of commercial nuclear power facilities to mitigate the consequences of an ATWS event. The licensing bases for the ATWS rule for PNPP is described in UFSAR Appendix 15C.

Based on the PNPP current licensing bases for ATWS, structure and system intended functions performed in support of 10 CFR 50.62 requirements were determined. The results of this determination are provided for mechanical systems in Section 2.3, Section 2.4 for structures and structural elements, and in Section 2.5 for electrical and instrument and controls systems

2.1.1.3.5 Station Blackout (10 CFR 50.63)

10 CFR 50.63 [Reference 1.3-7], requires that each light-water-cooled nuclear power plant be able to withstand, for a specified duration, and recover from a station blackout (SBO). An SBO is the loss of offsite and onsite AC electric power to the essential and nonessential switchgear buses in a nuclear power plant. It does not include the loss of AC power fed from inverters powered by station batteries or by alternate AC sources. The objective of this requirement is to assure that nuclear power plants can withstand an SBO while maintaining adequate reactor core cooling and containment integrity for the specified duration.

Appendix 15H of the UFSAR describes the licensing bases for SBO at PNPP. PNPP has developed a four-hour coping analysis to address the requirements of 10 CFR 50.63.

Based on the PNPP current licensing bases for SBO, structure and system intended functions performed in support of 10 CFR 50.63 requirements were determined. The results of this determination are provided for mechanical systems in Section 2.3, for structures in Section 2.4, and electrical commodities in Section 2.5.

The boundary for SBO is the step-up station transformer for Unit 1 and Unit 2. For Station Blackout Recovery, the boundary is extended to the first interconnection device that would restore offsite power to the main switchyard busses and then to the step-up station transformer. At PNPP, the boundary with the offsite transmission system has been defined at the 345kV switchyard circuit breakers: breakers S-612, S-620, S-621, S-650, S-652, S-660 and S-661. Refer to scoping boundary drawing 206-0010 LR. This boundary definition is consistent with NUREG-1800 [Reference 1.3-9], Section 2.1.3.1.

The Transmission Yard Control House (and associated EIC components) is not credited for offsite power supply reliability or station blackout recovery and is not in the scope of license renewal.

2.1.1.3.6 Cascading Systems in Regulated Events

NUREG-1800 [Reference 1.3-9], Table 2.1-2, “Specific Staff Guidance on Scoping,” under the discussion of “cascading,” identifies that any support system (identified by its CLB, actual plant-specific experience, industrywide experience, as applicable, or existing engineering evaluations) that is specifically relied upon for compliance with, or operation within, the applicable NRC regulation shall not be excluded from scoping. However, second-, third-, or fourth-level support systems are not required to be included. Consistent with this guidance, cascading first-level support systems were included for scoping for regulated events.

2.1.1.4 Scoping of Retired/Abandoned Mechanical Components

A small number of PNPP Unit 1 mechanical fluid components have been retired or abandoned since operation began. Additionally, in August 1994, the Cleveland Electric Illuminating Company formally notified the NRC of the intent to permanently terminate construction activities for PNPP Unit 2. PNPP Units 1 and 2 were originally designed to share some structures and systems.

During Unit 2 construction, a substantial amount of Unit 2 system piping and equipment had been installed in the plant. Subsequently, design changes have been implemented that have retired/abandoned Unit 2 systems, structures and components. Some of the retired/abandoned Unit 2 piping systems are located within structures containing safety-related components and have connections to Unit 1 systems that could represent a source of water to the retired/abandoned piping, or may be configured to retain trapped water. Additionally, some retired/abandoned piping components continue to provide structural/seismic support to attached safety-related Unit 1 piping. In these cases, the retired/abandoned piping performs a 10 CFR 54.4(a)(2) [Reference 1.3-1] function for license renewal.

Documentation (drawings, calcs, etc.) was reviewed for each interface with the retired/abandoned components and/or the components were walked down to determine their status. Piping components (including retired/abandoned piping) that provide structural/seismic support for safety-related piping, or that may contain fluid (water, steam, or oil) in structures that contain safety-related components are within scope of license renewal and are highlighted on license renewal drawings. Retired/abandoned piping components within structures containing safety-related components were only excluded from scope when all the following conditions were met:

- The piping components do not provide structural/seismic support to attached safety-related piping.
- The piping is separated from sources of water by blanks or flanges. Closed valves are not credited to keep fluid from retired/abandoned components.
- The piping is known to be empty of fluid. Empty status was established by configuration (such as the piping being open-ended at the low point), or by ultrasonic testing (UT) or other method that can confirm the absence of trapped fluid.

The review included consideration of abandoned components within structures containing safety-related components whose source of water is via a system connection outside of the safety-related structure, or that have no connection to an in-service system, but may contain trapped water. Retired/abandoned piping components that are located entirely outside of structures containing safety-related components do not perform a function corresponding to 10 CFR 54.4(a)(2) and are not within scope of license renewal.

The results of the scoping evaluations for Unit 2 and abandoned systems structures and components are provided for mechanical systems in Section 2.3, for structures in Section 2.4, and electrical commodities in Section 2.5.

2.1.2 SCREENING METHODOLOGY

Screening is the process for determining which in-scope structures and components require aging management review. Screening is governed by 10 CFR 54.21(a) [Reference 1.3-1], which states:

(1) For those systems, structures, and components within the scope of this part, as delineated in § 54.4, identify and list those structures and components subject to an aging management review. Structures and components subject to an aging management review shall encompass those structures and components—

(i) That perform an intended function, as described in §54.4, without moving parts or without a change in configuration or properties. These structures and components include, but are not limited to, the reactor vessel, the reactor coolant system pressure boundary, steam generators, the pressurizer, piping, pump casings, valve bodies, the core shroud, component supports, pressure retaining boundaries, heat exchangers, ventilation ducts, the containment, the containment liner, electrical and mechanical penetrations, equipment hatches, seismic Category I structures, electrical cables and connections, cable trays, and electrical cabinets, excluding, but not limited to, pumps (except casing), valves (except body), motors, diesel generators, air compressors, snubbers, the control rod drive, ventilation dampers, pressure transmitters, pressure indicators, water level indicators, switchgears, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies; and

(ii) That are not subject to replacement based on a qualified life or specified time period.

(2) Describe and justify the methods used in paragraph (a)(1) of this section.

(3) For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

For a structure, system component, structural element, or commodity that is within the scope of license renewal, the screening process determines:

- Whether it performs a component intended function without moving parts and without a change in configuration or properties (i.e., it is passive); and,
- Whether it is not subject to replacement based on a qualified life or specified time period (i.e., it is long-lived).

NEI 95-10 [Reference 1.3-3] provides industry guidance for screening structures and components to identify the passive, long-lived structures and components that support an intended function. The screening process for PNPP followed the recommendations of NEI 95-10.

10 CFR 54.21(a)(2) requires that the IPA include a description and justification of the methods used to determine the "passive, long-lived" structural elements and components. Although the requirements for the IPA are the same for each system and structure, the screening process differs for mechanical systems, electrical systems, and structures. The three separate screening processes are described below.

2.1.2.1 Screening of Mechanical Systems and Drawing Preparation

Within the group of systems that are within the scope of license renewal, the passive, long-lived components require aging management review. Components that are either active or subject to replacement based on a qualified life or specified time period do not require an aging management review.

The identification of components subject to aging management review began with the determination of the system evaluation boundary. The system evaluation boundary includes those portions of the system that are necessary to ensure that the intended functions of the system will be performed. Components needed to support each of the system-level intended functions identified in the scoping process are included within the system evaluation boundary.

Within the system evaluation boundary, long-lived passive components that perform or support an intended function without moving parts or a change in configuration or properties are subject to aging management review.

In making the determination that a component is passive (i.e., its intended function is performed without moving parts or a change in configuration or properties), it is not necessary to consider the component parts. However, in the case of valves, pumps, fans, and dampers, the valve bodies, pump casings, and housings for fans and dampers perform an intended function by maintaining the pressure boundary and are therefore subject to an aging management review. If the component is not subject to replacement based on a qualified life or specified time period, then it is considered long-lived. Some components are subject to replacement based on vendor recommendations, plant experience, or any means that establishes a specific service life, qualified life or replacement frequency. Components that are periodically replaced under an administratively controlled process are not included in the aging management review.

License renewal drawings are created by highlighting mechanical flow diagrams to indicate those components that are within the system evaluation boundaries (i.e., that support system intended functions and are thus within scope) and are passive. Components that are periodically replaced may be highlighted and may also be identified as short-lived (and therefore not subject to aging management review) with a drawing note or textually within scoping reports.

Scoping and screening of components within each in-scope mechanical system began with a list of all system components and associated data downloaded from the SAP functional location database, along with applicable system flow diagrams. First, components that support one of the system functional scoping criteria (i.e., those that were not added to scope to address spatial interactions per 10 CFR 54.4(a)(2) [Reference 1.3-1] are highlighted in red. Next, nonsafety-related components within safety-related structures that contain steam, water or other liquid (such as oil) were highlighted in blue. Then, an evaluation of all safety-related to nonsafety-related transitions was conducted as described in Section 2.1.1.2.2 to ensure all components that provide structural support to safety-related components were included within scope. Green highlighting was used to identify components that perform only this structural support function. As these components were identified on the drawing, component data was downloaded from the SAP functional location database and annotated to identify component-level scoping results. The component data was also annotated to screen out active and short-lived components. This process ensured that all mechanical components downloaded from the SAP functional location database were evaluated for in-scope systems. Component types that appear on the drawing and perform an intended function but do not exist in the SAP functional location database (such as piping and bolting) were manually added to the downloaded component list.

Safety-related instrument air solenoid valves (and their associated air tubing) that open to relieve pressure and fail to a safe position upon loss of pressure boundary were not highlighted on drawings, and do not require aging management review because their only intended function is active; maintaining a passive pressure boundary is not an intended function for these components.

Some mechanical components, when combined, are considered a complex assembly. A complex assembly is a predominately active component where the performance of its components is closely linked to that of the intended function of the entire assembly, such that testing and monitoring of the assembly is sufficient to identify degradation of these components. Examples of complex assemblies include diesel engines, instrument air compressors, and chiller units. Complex assemblies are considered active and can be excluded from the requirements of AMR. However, to the extent that complex assemblies include piping or components that interface with external equipment, or components that cannot be adequately tested or monitored as part of the complex assembly, those components are identified and subject to AMR. This approach follows the screening methodology for complex assemblies as described in Table 2.1-2 of NUREG-1800. The components subject to AMR on the complex assembly are highlighted on drawings, but the complex assemblies (i.e., active sub-components, e.g., diesel engines or Control Complex chillers) may not be highlighted.

2.1.2.2 Screening of Structures

10 CFR 54.21(a)(2) requires that the IPA include a description and justification of the methods used to determine the “passive, long-lived” structural elements and commodities. Within the group of structures that are within the scope of license renewal, the passive, long-lived structural elements, and commodities that perform intended functions require aging management review. Components that are either active or subject to replacement based on a qualified life or specified time period do not require an aging management review.

The identification of components subject to AMR begins with the determination of the structure evaluation boundary. The structure evaluation boundary generally includes the entire structure. Structural elements and commodities needed to support each of the structure-level intended functions identified in the scoping process are included within the structure evaluation boundary.

Within the structure evaluation boundary, long-lived passive components that perform or support an intended function without moving parts or a change in configuration or properties are subject to aging management review. In accordance with 10 CFR 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants*, [Reference 1.3-1], an in-scope structure (e.g., Auxiliary Building) contains inherently passive long-lived structural elements and commodities. Those structural elements and commodities that perform an intended function are identified in the AMR report.

The evaluation boundaries for mechanical component supports were established in accordance with the rules governing inspection of component supports (i.e., ASME Section XI, Subsection IWF). Component support examination boundaries for integral and non-integral (i.e., mechanically attached) supports are defined in article IWF-1300, Figure IWF-1300-1. In general, the support boundary extends to the surface of the building structure but does not include the building structure. Furthermore, the support boundary extends to include non-integral attachments to piping and equipment but does not include integral attachments to the same. Component support examination boundaries for non-ASME in-scope components included the structural component and the associated attachment to the building structure (e.g., structural component supports for heating, ventilation, and air-conditioning ducts include duct support members, baseplates, and anchorages).

Supports for electrical components include cable trays, conduit, cable tray and conduit supports, electrical panels, racks, cabinets and other enclosures. The evaluation boundary for these items includes supporting elements, including mechanical or integral attachment to the building structure.

Evaluation boundaries for other structural members whose function is to carry dynamic loads caused by postulated design basis events were determined consistent with the method for establishing boundaries for supports described above. That is, the boundary was evaluated including the structural component and the associated attachment to the building structure. The portion of the attachment embedded in the building structure was considered part of the structure.

The screening process for structural elements and commodities involves review of design and licensing basis documents (UFSAR, drawings, etc.) to identify specific structural elements and commodities that make up the structure. Structural elements and commodities typically have no unique functional location identifiers like those assigned to mechanical components. Therefore, grouping structural elements and commodities based on materials of construction first and then subdividing them based on structural elements or commodity design and functions provides a practical means of categorizing them for AMR.

Section 2.4 presents the results of the screening process for structures and structural commodities.

2.1.2.3 Screening of Electrical Systems

Electrical and I&C systems, and electrical components within mechanical systems, did not require further system evaluations to determine which components were required to perform or support the identified intended functions. A bounding scoping approach is used for electrical equipment. All electrical components within in-scope systems were included within the scope of license renewal. In-scope electrical components were placed into commodity groups and were evaluated as commodities during the screening process.

The screening phase for electrical components starts by comparing in-scope commodity types to the commodity types listed in Appendix B of NEI 95-10 [Reference 1.3-3]. NEI 95-10 provides guidance for determining whether the commodities are active or passive. Active commodities are screened out.

Short-lived components or commodities do not require aging management review, so the short-lived components are screened out. 10 CFR 54.21 (a)(1)(ii) [Reference 1.3-1] allows the exclusion of those commodities that are subject to replacement based on a qualified life or specified time period. Electrical commodities included in the Environmental Qualification (EQ) Program meet that exclusion criterion. This is because those components and commodities have defined qualified lives and are replaced prior to the expiration of their qualified lives.

Section 2.5 presents the results of the screening process for electrical and I&C systems.

2.1.2.4 Stored Equipment

Stored equipment that has an SAP functional location database entry is evaluated with the applicable system. Some equipment not in the SAP functional location database is staged for use by the fire brigade, such as smoke ejectors and ventilation trunks, but is not relied upon for fire protection or safe shutdown. Other fire-fighting equipment, such as extinguishers, air packs and fire hoses are addressed as consumables. Additional equipment is staged for beyond-design-basis events. No stored equipment (i.e., without an SAP functional location database entry) is subject to aging management review per 10 CFR 54.21(a) [Reference 1.3-1].

2.1.2.5 Consumables

Consumables include such items as packing, gaskets, component seals, O-rings, structural sealants, oil, grease, component filters, system filters, fire extinguishers, fire hoses, and air packs. Consumables have been evaluated consistent with the information presented in Table 2.1-3 of NUREG-1800 [Reference 1.3-9]. Consumables have been divided into the following four categories for the purpose of license renewal: (a) packing, gaskets, component seals, and O-rings; (b) structural sealants; (c) oil, grease, and component filters; and (d) system filters, fire extinguishers, fire hoses, and air packs.

- Group (a) subcomponents (packing, gaskets, component seals, and o-rings) – These items are commonly found in components such as valves, pumps, heat exchangers, ventilation units or ducts, and piping segments. Based on ANSI B31.1 and the ASME Boiler and Pressure Vessel Code Section III, these subcomponents of pressure-retaining components are not pressure-retaining parts. Therefore, these subcomponents are not relied on to perform a pressure-retaining function and are not subject to aging management review.

- Group (b) structural sealants - structural sealants perform an intended function without moving parts or change in configuration and are not typically replaced. Therefore, structural sealants were determined to be subject to AMR based on their application and are evaluated as bulk commodities in Section 2.4.4.

- Group (c) subcomponents (oil, grease, and component filters) – these items have been treated as consumables because they are either periodically replaced, or they are monitored and replaced based on condition. Therefore, these subcomponents are not subject to aging management review.

- Group (d) consumables (system filters, fire extinguishers, fire hoses, and air packs) – these items are considered to be consumables and are routinely tested, inspected, and replaced when necessary. System filters are monitored during testing and operation and are either replaced periodically or on condition. Fire hoses and fire extinguishers are inspected and pressure tested periodically and must be replaced if they do not pass the test or inspection. Breathing air apparatus and air cylinders are inspected and tested periodically and must be replaced if they do not pass the test or inspection. Fire protection procedures specify the replacement criterion of these components that are routinely checked by tests or inspections to assure operability. Criteria for inspection and replacement are based on accepted industry standards (e.g., Branch Technical Position BTP-APCSB 9.5.1, NFPA-10 for fire extinguishers, NFPA-1962 for fire hoses, 29 CFR 1910.134 for air packs). Therefore, while these consumables are within the scope of license renewal, they do not require an aging management review.

2.1.3 INTERIM STAFF GUIDANCE DISCUSSION

As discussed in NEI 95-10 [Reference 1.3-3], the NRC has encouraged applicants for license renewal to address interim staff guidance (ISGs) in the LRA. The following LR-ISGs are currently active on the NRC website:

LR-ISG-2011-01: AGING MANAGEMENT OF STAINLESS STEEL STRUCTURES AND COMPONENTS IN TREATED BORATED WATER, Revision 1: This ISG recommends the use of the One-Time Inspection program in addition to Water Chemistry to manage aging in oxygenated treated borated water environments. PNPP is a BWR and does not have a treated borated water environment that corresponds to the environment of concern in this ISG.

LR-ISG-2011-02: AGING MANAGEMENT PROGRAM FOR STEAM GENERATORS: This ISG recommends that applicants for license renewal follow the guidance provided in

Revision 3 of NEI 97-06 when implementing their steam generator aging management program. PNPP is a BWR and does not have steam generators.

LR-ISG-2011-03: GENERIC AGING LESSONS LEARNED (GALL) REPORT REVISION 2, AMP XI.M41, “BURIED AND UNDERGROUND PIPING AND TANKS:” LR-ISG-2011-03 program description in Appendices A and B have been replaced by LR-ISG-2015-01, and no further action in this regard is required by this LR-ISG. This ISG also includes associated revisions to the tabular recommendations of NUREG-1801 and NUREG-1800 pertaining to AMR line items. This LRA is consistent with the recommendations of LR-ISG-2011-03 in the AMR tables of Section 3.

LR-ISG-2011-04: UPDATED AGING MANAGEMENT CRITERIA FOR REACTOR VESSEL INTERNAL COMPONENTS OF PRESSURIZED WATER REACTORS: This ISG addresses aging management of PWR components. PNPP is a BWR, for which these recommendations are not applicable.

LR-ISG-2011-05: ONGOING REVIEW OF OPERATING EXPERIENCE: This ISG addresses the evaluation of site and industry operating experience that may be age-related. PNPP will continue to implement operating experience reviews consistent with LR-ISG-2011-05. LRA Appendix A, section A-1 and Appendix B, section B.1.4, describe the operating experience program to maintain aging management programs.

LR-ISG-2012-01: WALL THINNING DUE TO EROSION MECHANISMS: This ISG provides recommendations for management of wall thinning due to various erosion mechanisms and revises the NUREG-1801 [Reference 1.3-8], XI.M17 Flow-Accelerated Corrosion (FAC) program recommendations. This LRA is consistent with the recommendations of LR-ISG-2012-01 in the AMR tables in Section 3, and in the program evaluation in Appendix B, section B.2.22.

LR-ISG-2012-02: AGING MANAGEMENT OF INTERNAL SURFACES, FIRE WATER SYSTEMS, ATMOSPHERIC STORAGE TANKS, AND CORROSION UNDER INSULATION: This ISG revises the recommendations of six programs in NUREG-1801. This LRA is consistent with the recommendations of LR-ISG-2012-02 in the AMR tables in Section 3, and in the program evaluations in Appendix B, sections B.2.2, B.2.15, B.2.18, B.2.21, B.2.25 and B.2.37.

LR-ISG-2013-01: AGING MANAGEMENT OF LOSS OF COATING OR LINING INTEGRITY FOR INTERNAL COATINGS/LININGS ON IN-SCOPE PIPING, PIPING COMPONENTS, HEAT EXCHANGERS, AND TANKS: This ISG provides recommendations for management of loss of coating or lining integrity on in-scope components and adds a new program to address these recommendations in NUREG-1801. This LRA is consistent with the recommendations of LR-ISG-2013-01 in the AMR tables in Section 3, and in the program evaluation in Appendix B, section B.2.27.

LR-ISG-2015-01: CHANGES TO BURIED AND UNDERGROUND PIPING AND TANKS RECOMMENDATIONS: This ISG replaces aging management program (AMP) XI.M41, “Buried and Underground Piping and Tanks,” and the associated Updated Final Safety Analysis Report Summary Description in LR-ISG-2011-03, “Changes to the Generic Aging Lessons Learned (GALL) Report, Revision 2 Aging Management Program (AMP) XI.M41, 'Buried and Underground Piping and Tanks'." In addition, recommendations contained within AMP XI.M41 related to reductions in the extent of inspections to manage selective leaching in buried components were relocated to AMP XI.M33, "Selective Leaching." This LRA is consistent with the recommendations of LR-ISG-2015-01 in the AMR tables in Section 3, and in the program evaluation in Appendix B, section B.2.8 and section B.2.42.

LR-ISG-2016-01: CHANGES TO AGING MANAGEMENT GUIDANCE FOR VARIOUS STEAM GENERATOR COMPONENTS: This ISG addresses aging management of PWR components. PNPP is a BWR, for which these recommendations are not applicable.

SLR-ISG-2021-01-PWRVI: UPDATED AGING MANAGEMENT CRITERIA FOR REACTOR VESSEL INTERNAL COMPONENTS FOR PRESSURIZED-WATER REACTORS: This ISG addresses aging management of PWR components for Subsequent License Renewal. PNPP is a BWR, for which these recommendations are not applicable.

SLR-ISG-2021-02-MECHANICAL: UPDATED AGING MANAGEMENT CRITERIA FOR MECHANICAL PORTIONS OF SUBSEQUENT LICENSE RENEWAL GUIDANCE: This ISG addresses aging management criteria applicable to Subsequent License Renewal and is not applicable for PNPP's initial license renewal. However, the ISG updates to aging management programs were considered as part of operating experience to optimize aging management program effectiveness.

SLR-ISG-2021-03-STRUCTURES: UPDATED AGING MANAGEMENT CRITERIA FOR STRUCTURES PORTIONS OF SUBSEQUENT LICENSE RENEWAL GUIDANCE: This ISG addresses aging management criteria applicable to Subsequent License Renewal and is not applicable for PNPP's initial license renewal. However, the ISG updates to aging management programs were considered as part of operating experience to optimize aging management program effectiveness.

SLR-ISG-2021-04-ELECTRICAL: Updated Aging Management Criteria for Electrical Portions of Subsequent License Renewal Guidance: This ISG addresses aging management criteria applicable to Subsequent License Renewal and is not applicable for PNPP's initial license renewal. However, the ISG updates to aging management programs were considered as part of operating experience to optimize aging management program effectiveness.

Other Subsequent License Renewal (i.e., 60 to 80 years of operation) guidance documents are not applicable to Perry's initial license renewal. However, these documents are treated as operating experience that may be relevant. This operating experience has been considered in the PNPP IPA and applied as appropriate, on a limited basis. The AMR results in Section 3 may include a plant-specific note for line items that include clarification from SLR operating experience. Similarly, AMP descriptions in Appendix B indicate when an element(s) of the program is clarified by SLR operating experience. The other SLR guidance documents that contain potential operating experience applicable to PNPP include:

NUREG-2191 Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report (Reference 1-16); and,

NUREG-2192 Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (Reference 1-17).

2.1.4 GENERIC SAFETY ISSUES

In accordance with the guidance in NEI 95-10 (Reference 1.3-3) and Appendix A.3 of NUREG-1800 (Reference 1.3-9), review of NRC generic safety issues (GSIs) as a part of the license renewal process is required to satisfy the finding required by 10 CFR 54.29. GSIs designated as unresolved safety issues (USIs) and High - and Medium - priority issues in NUREG-0933, Appendix B (Reference 1.3-14), that involve aging effects for structures and components subject to an aging management review or time-limited aging analysis evaluations are to be addressed in the LRA. A review of NUREG-0933 dated 2021, Supplement 35 (current six months prior to the license renewal application submittal), determined that there were no outstanding USIs or High- or Medium-priority GSIs. Two GSIs (199 and 204) are identified as, "Currently open in Regulatory Office Implementation," in NUREG-0933, Appendix B. These were reviewed for aging effects for structures and components subject to an aging management review or TLAAs relevant to the license renewal application.

GSI-199 'Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants,' addresses how current estimates of the seismic hazard level at some nuclear sites in the central and eastern United States might be higher than the values used in their original designs and previous evaluations. The issue does not involve TLAA evaluations or aging effects.

GSI-204 'Flooding of Nuclear Power Plant Sites Following Upstream Dam Failure,' relates to potential flooding effects from upstream dam failure on nuclear power plant sites, spent fuel pools, (SFPs), and sites undergoing decommissioning with spent fuel stored in SFPs. The issue does not involve TLAA evaluations. The PNPP is not situated downstream of any dams that might fail. However, barriers to external and internal flooding are in the scope of LR and subject to AMR, as described in Section 2.4.

2.1.5 CONCLUSION

The methods described in Sections 2.1.1 and 2.1.2 were used at PNPP to identify the systems and structures that are within the scope of license renewal and to identify those structures and components requiring aging management review. The methods are consistent with and satisfy the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1).

2.2 PLANT LEVEL SCOPING RESULTS

Tables 2.2-1 and 2.2-2 list the mechanical systems and structures which are within the scope of license renewal for PNPP. The tables reflect a reference to the sections of this LRA which describes the system or structure.

Tables 2.2-3 and 2.2-4 list the EIC and structural systems. For each item on these lists, the tables also provide a reference (if applicable) to the section(s) of the UFSAR that describes the system or structure. For systems with no applicable UFSAR reference, a brief description is provided. As noted in Section 2.1.1, neither EIC nor structural scoping was performed based on system functional grouping. As such, the EIC and structural systems were not evaluated for scoping for EIC components and structures. However, the SAP functional location database includes systems that perform exclusive EIC or structural functions. As a result, Tables 2.2-3 and 2.2-4 are provided for a complete listing of the system functional locations.

Tables 2.2-5 and 2.2-6 list mechanical systems and structures that do not meet the criteria specified in 10 CFR 54.4(a) and are therefore excluded from the scope of license renewal. For each item on these lists, the table also provides a reference (if applicable) to the section of the UFSAR that describes the system or structure. For systems with no applicable UFSAR reference, a brief description is provided.

The list of systems used in these tables and determination of system boundaries is based on the PNPP SAP functional location database. The SAP functional location database is a controlled list of plant systems and components, with each component assigned to one plant system. Mechanical system intended functions are identified in the sections referenced in Table 2.2-1. Intended functions for in-scope structures are identified in the sections referenced in Table 2.2-2.

The list of plant structures was developed from a review of the UFSAR, plant layout drawings, Fire Hazards Analysis Report, design criteria documents, and maintenance rule basis documents. Structure intended functions are identified in the section referenced in Table 2.2-2. Structural commodities associated with mechanical systems, such as pipe supports and insulation, are evaluated with the structural bulk commodities.

As needed, system components are grouped functionally for the aging management review. For example, ASME Class 1 components in various systems are evaluated as the Reactor Coolant Pressure Boundary System in Section 2.3.1.3. For each system, the discussion under “System Boundary” provides further information.

Table 2.2-1
Mechanical Systems within the Scope of License Renewal

System Label	System Name	LRA Section Describing System
B13a	Reactor Vessel (RXV)	2.3.1.5
B13b	Reactor Vessel Internals (RVI)	2.3.1.6
B21	Nuclear Boiler	2.3.1.2
B33	Reactor Recirculation	2.3.1.4
C11	Control Rod Drive	2.3.3.12
C34	Feed Water Control	2.3.4.6
C41	Standby Liquid Control	2.3.3.56
D17	Plant Radiation Monitoring	2.3.3.45
D19	Post-Accident Radiation Monitoring	2.3.3.45
D23	Containment Atmosphere Monitoring	2.3.2.3
E12	Residual Heat Removal	2.3.2.8
E15	Containment Spray	2.3.2.8
E21	Low Pressure Core Spray	2.3.2.5
E22	High Pressure Core Spray (Division 3 diesel generator subsystems evaluated with Division 1 & 2 diesels in R43 thru R48.)	2.3.2.4
E31	Leak Detection	2.3.3.32
E51	Reactor Core Isolation Cooling	2.3.2.7
E61	Containment Integrated Leak Rate Test	2.3.3.7
F13	Reactor Vessel Servicing Equipment	2.3.3.50
F16	Fuel Storage Equipment	2.3.3.27
F42	Inclined Fuel Transfer System	2.3.3.29
G33	Reactor Water Clean Up	2.3.3.51
G36	Reactor Water Clean Up Filter and Demineralizer	2.3.3.51
G40	Alternate Decay Heat Removal	2.3.2.1
G41	Fuel Pool Cooling and Cleanup	2.3.3.27
G42	Suppression Pool Drain and Clean Up	2.3.3.59

Table 2.2-1
Mechanical Systems within the Scope of License Renewal

System Label	System Name	LRA Section Describing System
G43	Suppression Pool Makeup	2.3.3.60
G50	Liquid Radwaste Disposal	2.3.3.33
G60	Miscellaneous Sump	2.3.3.38
G61	Liquid Radwaste Sumps	2.3.3.34
J11	Fuel	2.3.1.1
L58	Respirator Cleaning	2.3.4.10
L59	Control Rod Drive Rebuild Equipment	2.3.4.4
M14	Containment Vessel and Drywell Purge	2.3.3.8
M15	Annulus Exhaust Gas Treatment	2.3.2.2
M16	Drywell Vacuum Relief	2.3.3.6
M17	Containment Vacuum Relief	2.3.3.6
M21	Controlled Access and Misc. Equipment Areas HVAC	2.3.3.14
M23	MCC Switchgear and Misc. Electrical Area HVAC	2.3.3.35
M24	Battery Room Exhaust	2.3.3.35
M25	Control Room HVAC	2.3.3.13
M26	Control Room Emergency Recirculation	2.3.3.13
M27	Computer Room HVAC	2.3.3.5
M28	Emergency Closed Cooling Pump Area HVAC	2.3.3.19
M29	Control and Computer Room Humidification	2.3.3.10
M31	Radwaste Building Ventilation	2.3.3.49
M32	Emergency Service Water Pump House Ventilation	2.3.3.21
M33	Intermediate Building Ventilation	2.3.3.31
M35	Turbine Building Ventilation	2.3.3.63
M36	Off Gas Building Ventilation	2.3.3.41
M38	Auxiliary Building Ventilation	2.3.3.1
M39	ECCS Pump Room Cooling	2.3.3.17

Table 2.2-1
Mechanical Systems within the Scope of License Renewal

System Label	System Name	LRA Section Describing System
M40	Fuel Handling Area Ventilation	2.3.3.26
M43	Diesel Generator Building Ventilation	2.3.3.16
M46	Miscellaneous Area Ventilation	2.3.3.36
M47	Steam Tunnel Cooling	2.3.3.57
M49	Miscellaneous Electrical Areas Smoke Ventilation	2.3.3.37
M51	Combustible Gas Control	2.3.3.4
N11	Main and Reheat Steam	2.3.4.8
N21	Condensate System	2.3.4.2
N22	Main, Reheat, Extraction, and Misc. Drain	2.3.4.9
N27	Feedwater and Feedwater Leakage Control	2.3.4.6
N36	Extraction Steam	2.3.4.5
N61	Main Condenser (including the main turbine shell)	2.3.4.7
N64	Off Gas	2.3.2.6
P11	Condensate Transfer and Storage	2.3.4.3
P21	Two Bed Demineralizer and Distribution	2.3.4.12
P22	Mixed Bed Demineralizer and Distribution	2.3.4.12
P35	Reactor Plant Sampling	2.3.3.48
P41	Service Water	2.3.3.55
P42	Emergency Closed Cooling	2.3.3.18
P43	Nuclear Closed Cooling	2.3.3.40
P44	Turbine Building Closed Cooling	2.3.3.62
P45	Emergency Service Water	2.3.3.20
P46	Turbine Building Chilled Water	2.3.3.61
P47	Control Complex Chilled Water	2.3.3.11
P48	Service Water and Emergency Service Water Chlorination	2.3.4.11
P49	Emergency Service Water Screen Wash	2.3.3.22

Table 2.2-1
Mechanical Systems within the Scope of License Renewal

System Label	System Name	LRA Section Describing System
P50	Containment Vessel Chilled Water	2.3.3.9
P51	Service Air	2.3.3.54
P52	Instrument Air	2.3.3.54
P53	Penetration Pressurization	2.3.3.43
P54	Fire Protection	2.3.3.24
P55	Building Heating	2.3.3.3
P57	Safety-Related Instrument Air	2.3.3.52
P58	Breathable Air	2.3.3.2
P61	Auxiliary Steam and Drains	2.3.4.1
P64	Industrial Waste Disposal	2.3.3.30
P66	Sanitary Drain and Sewer	2.3.3.53
P67	Storm Drain and Sewer	2.3.3.58
P68	Floor and Equipment Drains	2.3.3.25
P71	Potable Water Supply	2.3.3.47
P72	Plant Foundation Underdrain	2.3.3.44
P73	Hydrogen Water Chemistry	2.3.3.28
P85	Feedwater Zinc Injection	2.3.3.23
P86	Nitrogen Supply	2.3.3.39
P87	Post-Accident Sampling	2.3.3.46
R43	Division 1 & 2 Standby Diesel and Control Air	2.3.3.15
R44	Diesel Generator Starting Air	2.3.3.15
R45	Diesel Generator Fuel Oil	2.3.3.15
R46	Diesel Generator Jacket Water	2.3.3.15
R47	Diesel Generator Lube Oil	2.3.3.15
R48	Diesel Generator Intake Air and Combustion Exhaust	2.3.3.15
R72	Penetration Electrical	2.3.3.42

Table 2.2-1
Mechanical Systems within the Scope of License Renewal

System Label	System Name	LRA Section Describing System
RCPB	Reactor Coolant Pressure Boundary (Artificial System Comprised of Class 1 Pressure Boundary Components)	2.3.1.3
T21	Suppression Pool	2.3.2.9

Table 2.2-2
Structures and Structural Components within the Scope of License Renewal

Structure Name	LRA Section
Auxiliary Boiler Building	2.4.2.4
Auxiliary Building, Unit 1	2.4.2.6
Auxiliary Building, Unit 2	2.4.2.15
Bulk Commodities	2.4.4
Central Oil Unloading/Tank Fill Station	2.4.2.21
Circulating Water Pumphouse, Unit 1	2.4.2.23
Condensate Storage Tank dike and instrument missile shield	2.4.2.24
Containment Structure (includes the Reactor/Shield Building and containment vessel, annulus concrete, drywell, suppression pool, weir wall, and refueling and reactor servicing areas)	2.4.1
Control Complex	2.4.2.7
Cranes, Trolleys, Monorails and Hoists (L51) are evaluated as structural components or commodities of the structures in which they are located	2.4.4
Diesel Generator Building	2.4.2.8
Diesel Generator Fuel Oil Tank Maintenance Structures	2.4.2.22
Emergency Service Water (ESW) Pumphouse	2.4.3.1
ESW Intake and Alternate Intake Tunnels including Ice Protection Caissons, Intake Structures, and Discharge Structure	2.4.3.2
ESW Swale	2.4.3.3
Exterior Flood Protection	2.4.3.5
Fuel Oil Pumphouse	2.4.2.27
Foundations (Tanks, Transformers, Transmission Towers, etc.)	2.4.2.25
Fuel Oil Storage Tank dike	2.4.2.26
Heater Bay, Unit 1	2.4.2.5
Heater Bay, Unit 2	2.4.2.18
High Mast Light #7	2.4.2.28
Hose houses	2.4.2.29
Intermediate Building, including the Fuel Handling Building	2.4.2.9; 2.4.2.10

Table 2.2-2
Structures and Structural Components within the Scope of License Renewal

Structure Name	LRA Section
Major Stream, Remnant Minor Stream, Diversion Stream and Diversion Stream Berm	2.4.3.3
Minor Stream Diversion Channel Outlet	2.4.3.3
Manholes including permanent curbs, and Duct Banks and Trenches	2.4.2.30
Offgas Building, Unit 1	2.4.2.11
Offgas Building, Unit 2	2.4.2.19
Oil Interceptor Tanks	2.4.3.4; 2.4.4
Primary Access Facility	2.4.2.31
Radioactive Waste Building	2.4.2.12
Railroad Bridge	2.4.2.32
Reactor Building Complex, Unit 2	2.4.2.14
Service Building	2.4.2.13
Service Water Valve Pit	2.4.2.33
Spent Fuel Dry Storage (SFDS) Electrical Building	2.4.2.34
Steam Tunnel, Unit 1	2.4.2.3
Steam Tunnel, Unit 2	2.4.2.20
Thrust blocks	2.4.2.35
Transformers (U1 Main, U1/2 Startup, U1/2 Interbus) Concrete Curbs and Fire Barriers	2.4.2.36
Transmission Towers	2.4.2.37
Turbine Building, Unit 1	2.4.2.1
Turbine Building, Unit 2	2.4.2.16
Turbine Power Complex (Condensate Demineralizer Building), Unit 1	2.4.2.2
Turbine Power Complex (Condensate Demineralizer Building), Unit 2	2.4.2.17
Valve Support Slabs	2.4.2.38
Water Treatment Building	2.4.2.39

Table 2.2-3
Electrical and I&C Systems

System Label	System Name	System Function or UFSAR Reference
C22	Redundant Reactivity Control	7.6.1.12
C61	Remote Reactor Shutdown	7.4.1.4
C71	Reactor Protection	7.2
C91	Process Computer	7.7.1.8
C94	Health Physics Computer	The system provides means for assessment of plant effluent isotopic mixtures and quantities to ensure compliance with the license basis limits
C95	Emergency Response Information System	7.5.1.4.3
C96	Simulator	Components supporting the training simulator in the Training Building
D21	Area Radiation Monitoring	12.3.4
D51	Seismic Monitoring/Met Tower	2.3.3.4 /3.7
N41	Main Generator	10.2.2
M56	Hydrogen Ignition	7.6.1.9
P56	Plant Security	13.6
P98	Suppression Pool Corrosion Monitoring	Thermocouples/electrodes intended for monitoring of corrosion of the drywell wall suppression pool liner
P99	Post Fuel Load Vibrational and Thermal Testing	Temperature and vibration sensors used for plant start-up testing
R10	Plant Electrical	Chapter 8
R11	Station Transformers	Unit 1 and 2 Inter-bus transformers

Table 2.2-3
Electrical and I&C Systems

System Label	System Name	System Function or UFSAR Reference
R14	120 Vac Vital (Inverters and Distribution)	Vital Balance-of-Plant (BOP) uninterruptable power supply (UPS), providing 120 Vac for the Control Room and the Computer Room, and the ATWS UPS for the APRMs, LPRMs and flow instruments used in the Nuclear Instrumentation System (C51)
R15	480 Vac Vital TSC (Inverters and Distribution)	TSC UPS, providing 480Vac for the Emergency Response Information System Computer (C95) and the Site Security Computer
R22	Metal Clad Switchgear (15kv and 5kv)	15kV and 5kV breakers can be manually operated (close and trip) locally at the breaker and operated remotely with control power
R23	Unit Load Centers (480v)	Provides a distribution point for major 480V electrical loads and is the source of 480V power to the Motor Control Centers (R24) and Distribution Panels (R25) throughout the plant
R24	Motor Control Centers (MCCs)	MCCs provide a means of controlling and servicing electrical loads, including Division 1, 2 and 3 Class 1E MCCs and Non-Class 1E MCCs
R25	Distribution Panels	Non-Class 1E distribution Panels provide a means of controlling and servicing smaller, diversified loads
R34	Grounding System	8.3.1.1.4.4
R35	Cathodic Protection System	9.5.4.3
R36	Heat Tracing and Freezing Protection	A nonsafety-related electric heat tracing system provides heating to various system piping runs

Table 2.2-3
Electrical and I&C Systems

System Label	System Name	System Function or UFSAR Reference
		throughout the PNPP site to prevent freezing during the winter months. It is also used to maintain a particular temperature range within a process stream.
R41	Instruments	Provides 24Vdc power for controllers, transmitters, indicators and annunciators for safety-related and nonsafety-related plant systems including: C61, D23, G41, G43, M43, M51, N21, N26, N27, P41, P42, P43, and P47
R42	DC Systems (Batteries, Chargers, and Switchgear)	8.3.2
R50	Outside Radio Communication	9.5.2.2.3
R51	Plant Party Line Page System	9.5.2.2.4
R52	Maintenance and Calibration Communication	9.5.2.2.6; 9A.5.D.5
R53	Exclusion Area Paging System	An independent PA system consisting of power amplifiers and high power speakers. The system is capable of broadcasting either a prerecorded message, or voice message using a hand-held microphone, which are audible over the entire exclusion area.
R54	Prompt Alert	A prompt alert siren system, which meets the design objectives of NUREG-0654, Appendix 3, is installed throughout the emergency planning zone in Lake, Geauga and Ashtabula Counties.
R55	Permanent Plant Telephone System	9.5.2.2.1
R56	Commercial Opx	9.5.2.2.1
R57	Two-Way Radio	9.5.2.2.3; 9A.5.D.5

Table 2.2-3
Electrical and I&C Systems

System Label	System Name	System Function or UFSAR Reference
R58	Training Center Electrical Equipment	Power distribution and lighting in the training center
R59	Miscellaneous Electrical (Non-Plant)	Fiber optic distribution equipment removed from design control supporting cell phone communications on site
R61	Main Control Room Annunciator	7.5
R63	Loose Parts Monitoring System	(Abandoned/removed)
R71	Lighting system	9.5.3
R74	Local Starters and Controls	Miscellaneous motor starters
S11	Power Transformers	Main transformers phase A, B, C; auxiliary transformer; Unit 1 and 2 start-up transformers
S41	Step Up Station	Disconnect switches for the main and startup transformers
S42	Transmission Station	8.2.1.2.1, 8.2.2.1

Table 2.2-4
Structural Systems

System Label	System Name	System Function or UFSAR Reference
F17	Under Reactor Vessel Servicing Equipment	Equipment used during outages for maintenance under the RPV, including control rod drive mechanism handling equipment.
H13	Control Room Panels	Panels/cabinets in the control room that house and support control room instrumentation.
H22	Local Panels and Racks (GE)	Control panels and instrument racks that house and support instrumentation throughout the plant.
H51	Local Panels and Racks (Non GE)	Control panels and instrument racks that house and support instrumentation throughout the plant.
L51	Cranes Hoists and Elevators	Plant building elevators and load handling equipment ranging from the reactor building polar crane to portable maintenance trollies.
L54	Rolling Steel Door Operators	Rolling steel doors, including roll-up fire doors, and operators in safety- and nonsafety-related structures.
P80	Seismic Clearance Violation Supports	Pipe and equipment supports in safety-related structures evaluated for adequacy of seismic clearance.
R33	Conduit and Tray Systems	Structural commodities that support and protect EIC cables.
T23	Containment	This system refers to the containment design. The only component with an SAP functional location is the drywell head. Note: structures comprising containment/drywell are evaluated as structures and not systems.

Table 2.2-5
Mechanical Systems Not within the Scope of License Renewal

System Label	System Name	System Function or UFSAR Reference
C51	Neutron Monitoring	The dry tubes for the probes and for the neutron detectors perform a reactor coolant pressure boundary function and are evaluated with the reactor vessel internals. The mechanical portions of the system include drive units, guide tubes, and indexing mechanisms, along with the purge air piping and valves to each indexing mechanism and drive unit. These components are not safety-related, and do not perform a license renewal intended function. Electrical components in the system are in the scope of license renewal. 1.2.2.6.2.3; 7.6.1.4.
C85	Steam Bypass and Pressure Regulator	1.2.2.5.6; 7.7.1.5; 10.4.4.2
E32	Main Steam Isolation Valves Leakage Control	The system is abandoned in place. The abandoned piping includes Shield Building and Auxiliary Building steam tunnel piping penetrations that have been capped to maintain Shield Building annulus and Auxiliary Building pressure boundary and fire barrier integrity. These capped penetrations are evaluated for License Renewal as part of Civil/Structural commodities. 1.2.2.4.21
F11	Fuel Handling and Vessel Service Equipment	Safety-related F11 fuel handling components are used for movement of fuel (fuel prep machines, general purpose grapple, new fuel inspection stand, fuel handling platform) are evaluated as civil/structural components. 1.2.2.7.2; 9.1.4.2.3.1; 9.1.4.2.3.2; 9.1.4.2.7.3; Table 9.1-3
F12	Service Aids	9.1.4.2.4

Table 2.2-5
Mechanical Systems Not within the Scope of License Renewal

System Label	System Name	System Function or UFSAR Reference
F14	In Vessel Servicing Equipment	9.1.4.2.6; Table 9.1-5; Table 9.1-7
F15	Refueling Equipment	The system is composed of the refueling and auxiliary platforms and their associated winches and supporting equipment. The refueling bellows that provides a seal to separate the drywell from the upper pool is evaluated with the Suppression Pool (T21). Safety-Related and Augmented Quality F15 Refueling Equipment (Refueling Platform, 360 Degree Auxiliary Platform) are evaluated as civil/structural components 9.1.4.2.7
G51	Solid Radwaste Disposal	1.2.2.9.3; 11.4
G52	Dry Active Waste	Equipment located in the Waste Abatement Reclamation Facility and addressed under the W99 system.
G58	Spent Fuel Dry Storage	10 CFR 54 is not applicable to spent fuel dry storage, as interim dry fuel storage licensing is regulated by 10 CFR 72, and renewal of dry fuel storage licenses is described in 10 CFR 72.42.
L52	Service Building Machine Shop Equipment	The system consists of Machine Shop tooling and a hoist used to support maintenance activities.
L53	Motor-Operated Louver Operators	The system consists of nonsafety ventilation air inlet and outlet louvers and associated motor operators installed in nonsafety-related structures, except for louvers in the elevator machinery rooms for the Intermediate and Radwaste Buildings. Failure of louvers in those rooms cannot adversely affect safety-related functions.
L55	Miscellaneous Architectural and Facility	The system consists of nonsafety door stops, range hoods and kitchen equipment for the Control Complex,

Table 2.2-5
Mechanical Systems Not within the Scope of License Renewal

System Label	System Name	System Function or UFSAR Reference
		Service Building, Water Treatment Building, and Training Center.
L60	Small Tool Decon Equipment	The system provides for cleaning and decontamination of small tools and components.
L70	Calibrated Test Equipment	The Calibrated Test Equipment system includes miscellaneous equipment and test instrumentation subject to periodic calibration. The system also monitors the WARF ventilation for airborne radioactivity and includes equipment to shred and compact dry waste in the WARF. 12.3.4.2; 12.5.2.3.3
M11	Containment Vessel Cooling	9.4.6.2.2; 9.4.6.3.2
M13	Drywell Cooling	9.4.6.2.1; 9.4.6.3.1
M37	Water Treatment Building Ventilation	9.4.12.2.1
M41	Heater Bay Ventilation	9.4.4.2.2
M42	Turbine Power Complex Ventilation	9.4.8.1; 9.4.8.2
M44	Service Building HVAC	Provides ventilation of working areas and offices inside the Service Building. 9A.4.18.1
M45	Circulating Water Pump House Ventilation	9.4.12.2.2
M48	Radwaste Building Control Room Ventilation	9.4.12.2.7
M50	Guard House (PAF) HVAC	9A.4.20.1; 9A.4.20.3
M52	Technical Support Center HVAC	9A.4.18; 9A.4.18.1; 12.6.6
M53	Training Center HVAC	9A.4.19.1
M54	Service Building Hot Machine Shop HVAC	The M54 system connects to the plant vent via the 2M38 system. Fire dampers located in 2M38 ductwork are scoped

Table 2.2-5
Mechanical Systems Not within the Scope of License Renewal

System Label	System Name	System Function or UFSAR Reference
		with the M38 system. 9A.4.18.1
N23	Condensate Filtration	1.2.2.5.8; 10.4.6.2; 10.4.6.3.a; 10.4.6.4
N24	Condensate Demineralization	1.2.2.5.8; 10.4.6.3.b; 10.4.6.4
N25	High Pressure Heater Drains and Vents	The N25 system supports thermal efficiency of the turbine heat cycle. The system routes condensate and non-condensable gases from the moisture separator reheaters and high-pressure heaters and maintains condensate level in these heaters. The system does not contain safety-related SSCs, does not contain nonsafety-related SSCs that mitigate accidents or transients, and does not contain nonsafety-related SSCs whose failure prevents safety-related SSCs from fulfilling their safety-related function. As such, it does not perform an intended function.
N26	Low Pressure Heater Drains and Vents	The N26 system supports thermal efficiency of the turbine heat cycle. The system routes condensate and non-condensable gases from low-pressure heaters and automatically maintains condensate level in these heaters. The system does not contain safety-related SSCs, does not contain nonsafety-related SSCs that mitigate accidents or transients, and does not contain nonsafety-related SSCs whose failure prevents safety-related SSCs from fulfilling their safety-related function. As such, it does not perform an intended function.
N31	Turbine	The function of the turbine to mitigate the radiological release of a Control Rod Drop Accident is evaluated with the N61 system. Ref. UFSAR 1.2.2.5.1, 10.2.2.2

Table 2.2-5
Mechanical Systems Not within the Scope of License Renewal

System Label	System Name	System Function or UFSAR Reference
N32	Main Turbine Control System EHC	The N32 system does not contain any mechanical components that are safety-related. Nonsafety-related N32 electrical components support the overspeed trip function. The functions of the main stop and control valves, the intermediate stop and intercept valves, and the extraction steam check valves to prevent or mitigate a turbine overspeed event are evaluated with the N11 and N36 systems. Ref. UFSAR 10.2.2.2, 10.2.2.3, 10.2.3.6.1.1, 10.2.2.4 and Table 10.2-1.
N33	Turbine Steam Seal	1.2.2.5.5, 10.4.3
N34	Turbine Lube Oil	The system supplies lubricating oil to the main turbine-generator and exciter for lubrication and heat removal and provides makeup oil for Hydrogen Seal Oil system.
N35	Generator H_2 and CO_2 Gas Control	10.2.5.1, 10.2.5.3
N39	Turning Gear	The turning gear slowly rotates the turbine shaft to prevent rotor distortion due to uneven heating or cooling during turbine startup or shutdown.
N42	Generator Hydrogen Seal Oil	10.2.5.3.3.a
N43	Generator Stator Cooling	The system cools the main generator stator windings and field excitation rectifiers.
N51	Excitation	1.2.2.5.1; 10.2.2.1
N62	Condenser Air Removal	System is in scope for electrical components only. For a low power Control Rod Drop Accident with mechanical vacuum pump(s) in operation, Plant Radiation Main Steam Line (MSL) Monitor A or C actuates the trip of the mechanical vacuum pumps

Table 2.2-5
Mechanical Systems Not within the Scope of License Renewal

System Label	System Name	System Function or UFSAR Reference
		and closure of the associated isolation valves. 1.2.2.5.4; 10.4.2.3; 15.4.9.5
N71	Circulating Water	1.2.2.5.7; 10.4.5
P12	Condensate Seal Water	The system provides seal water to several plant systems' valves to prevent leakage into the main and auxiliary condensers, and to support operation of the hotwell pumps and feedwater booster pumps.
P20	Makeup Water Pretreatment	1.2.2.8.7, 9.2.3
P33	Turbine Plant Sampling	1.2.2.8.9, 9.3.2
P34	Nuclear Sampling	1.2.2.8.9, 9.3.2
P40	Service Water Screen Wash	9.2.7.3
P62	Auxiliary Boiler Fuel Oil	9.5.10.2
P65	Auxiliary Boiler Chemical Treatment	9.5.10.2
P81	Preoperational Chemical Cleaning	The system supported initial system cleaning and transport of flush water to a chemical cleaning lagoon. Much of the system has been removed/ blanked-off.
P82	Miscellaneous Chemical Treatment	The system supports injection of hydrazine from a drum into the hotwell pumps suction or discharge headers.
P83	Cooling Tower Acid Addition	The system supports addition of chemicals to the Circulating Water system (N71).
P84	Cooling Tower Chlorination and Plant Discharge Dechlorination	The system injects sodium bisulfite for Dechlorination of discharge water.
R13	Isolated Phase Bus Duct Cooling	8.1
W99	Waste Abatement and Low Level Processing	9A.4.22; 11.4.2.2

Table 2.2-5
Mechanical Systems Not within the Scope of License Renewal

System Label	System Name	System Function or UFSAR Reference
X11	FLEX	FLEX system components that are installed or pre-staged to support the FLEX system function but are not normally connected to installed plant systems are not fluid-filled or are not within structures containing safety-related components. These components perform functions associated with NRC order EA-12-049, which does not correspond to one of the license renewal scoping criteria in 10 CFR 54.4(a). FLEX piping and valves that are physically connected to other systems and perform a pressure boundary or leakage boundary function are evaluated with those systems. FLEX pipe supports and equipment restraints are addressed as part of structural scoping.
X12	Spent Fuel Pool Spray (FLEX)	FLEX system components that are installed or pre-staged to support the FLEX system function but are not normally connected to installed plant systems are not fluid-filled or are not within structures containing safety-related components. These components perform functions associated with NRC order EA-12-049, which does not correspond to one of the license renewal scoping criteria in 10 CFR 54.4(a). FLEX piping and valves that are physically connected to other systems and perform a pressure boundary or leakage boundary function are evaluated with those systems. FLEX pipe supports and equipment restraints are addressed as part of structural scoping.
X13	Spent Fuel Pool level instrumentation (FLEX)	Components associated with the X13 FLEX system are primarily electrical/ I&C in nature and do not include mechanical components pressurized with steam/water fluid. These systems

Table 2.2-5
Mechanical Systems Not within the Scope of License Renewal

System Label	System Name	System Function or UFSAR Reference
		perform functions associated with NRC Order EA-12-051 and NEI 12-01 for beyond design basis events, which does not correspond to one of the license renewal scoping criteria in 10 CFR 54.4(a).
X14	Control Room Satellite Communication (FLEX)	Components associated with the X14 FLEX system are primarily electrical/ I&C in nature and do not include mechanical components pressurized with steam/water fluid. These systems perform functions associated with NRC Order EA-12-051 and NEI 12-01 for beyond design basis events which does not correspond to one of the license renewal scoping criteria in 10 CFR 54.4(a).
Z99	Non-Plant System	The system includes a nonsafety-related, buried, 1000 gallon drain collection tank north of the Training Center and various assets that do not correspond to system components.

Table 2.2-6
Structures and Structural Components
Not within the Scope of License Renewal

Structure Name	**Structure Function or UFSAR Reference**
Access ramps for construction	These ramps have no current function because they were buried during final site grading. Figure 9.5-22 (sheets 1 and 3).
Acid Storage Tank Buildings, one for each unit	Both buildings have been abandoned in place. The buildings have no safety function and failure will not compromise any safety-related system or component and will not prevent safe reactor shutdown. Section 3.3.2.3 and Figures 1.2-2, 1.2-18, 2.4-3 and 2.5-186.
Administration Building, includes the Startup Building	Provides space for administrative and plant support personnel. Figures 1.2-2, 2.4-3, 2.5-186 and 9.5-1.
Barge Slip	Abandoned. Sections 2.4.5.5.3.3, 2.4.5.5.6 and 2.5.1.2.1.1; and Figures 2.4-39, 2.4-42, 2.5-36, 2.5-37, 2.5-186 and 2D-27.
Carbon Dioxide Storage Tank Foundation	Provides support to the carbon dioxide gas storage unit 1P54A0007, which is not in scope. Figure 9.5-5.
Chemical Cleaning Lagoon	Used for environmental controls. Figures 1.2-2, 1.2-18, 2.1-3, 2.2-3, 2.4-3 and 2.5-186; and Table 2.4-12.
Circulating Water Forebay and Forebay Flume, Unit 1	Allow water to flow from the cooling tower basin to the Circulating Water Pumphouse. Section 10.4.5.1, Figure 1.2-14, and Table 3.2-1 XXXIV 11.
Circulating Water Pumphouse, Forebay and Forebay Flume, Unit 2	Abandoned, the structures have no safety function and failure will not compromise any safety-related system or component and will not prevent safe reactor shutdown. Sections 1.2.2.5.7, 3.3.2.3 and 10.4.5.1; and Figures 1.2-2, 1.2-14, 1.2-18, 2.4-3, 2.5-186 and 9.5-1.
Condensate Storage Tank 2P11A0001 Foundation, Unit 2	Abandoned, the Unit 2 Condensate Storage Tank has been removed. Figures 1.2-2 and 2.5-186.
Condensate Storage Tank Dike and Instrument Missile Shield, Unit 2	Removed. Figures 1.2-2, 2.5-186 and 3.8-74.

Table 2.2-6
Structures and Structural Components
Not within the Scope of License Renewal

Structure Name	**Structure Function or UFSAR Reference**
Construction Access Shafts	Temporary shafts used during construction. Appendix 2D, Section 2.2 and Figures 2D-2 (sheet 16), 2D-3, 2D-11, 2D-12 and 3.8-70.
Cooling Tower, Unit 1	Hyperbolically shaped concrete shell supported on a concrete foundation. Sections 1.2.2.5.7, 10.4.5.2 and 10.4.5.3; Figures 1.2-2, 2.4-3, 2.4-39A, 2.5-33, 2.5-34, 2.5-36, 2.5-37, 2.5-48, 2.5-53, 2.5-186, 2D-3, 2D-11, 2D-12, 2D-27, 2E-1, 9.2-10 and 9.5-7; and Table 2.4-9.
Cooling Tower, Unit 2	Abandoned. Sections 1.2.2.5.7 and 10.4.5.3; and Figures 1.2-2, 1.2-18, 2.1-3, 2.2-3, 2.4-3, 2.5-33, 2.5-36, 2.5-37, 2.5-48, 2.5-53, 2.5-186, 2D-3, 2D-11, 2D-12, 2D-27, 2E-1 and 9.5-7.
Decant Control Structure	Houses components used for environmental controls. Section 9.4.10.2e (page 9.4-120) and Figures 1.2-2 and 2.5-186.
Dechlorination Building (Equip. Bldg.)	Used for environmental controls. Section 9.4.10.2e (page 9.4-120) and Figures 1.2-2, 2.4-3, 2.5-186 and 2.5-203.
Demineralized Water Storage Tank Foundations	Tanks 0P21A0001 and 0P22A0001 are not in scope. Figures 2.4-3 and 2.5-186; and Table 2.4-12.
Diesel Generator Fuel Oil Tank maintenance structures, Unit 2	The Unit 2 tanks and associated structures have been abandoned. Sections 9.5.4.3 and 9.5.9.1.3; and Figures 1.2-2, 1.2-5, 9.5-21 (sheet 2) and 9.5-22 (sheets 1 and 2).
Discharge Tunnel Entrance Structure and Downshaft	Nonsafety-related lake water discharge pathway. Sections 9.4.10.2e (page 9.4-120) and 10.4.5.2; Figures 1.2-2, 2.4-3, 2.4-39, 2.4-69, 2.5-34, 2.5-36, 2.5-143 (Sheet 2), 2.5-186, 2.5-203, 2D-3, 2D-11, 2D-12, 2D-15, 3.8-65, 3.8-66, 3.8-70, 9.2-10 and 9.2-14 and Table 3.2-1 XXXIV 13.
Emergency Vehicle Garage (GAR)	Building removed. Figures 1.2-2, 2.4-3 and 2.5-32 (sheet 3).
Fire Equipment Storage Building	Located between the cooling towers.

Table 2.2-6
Structures and Structural Components
Not within the Scope of License Renewal

Structure Name	**Structure Function or UFSAR Reference**
Fire Equipment Storage Building (old name)	Located east of the ISFSI pad. Now used for storage of maintenance materials and equipment.
Fire Service Construction Water Pump House	Houses only components that are abandoned or not in scope. Figures 1.2-2 and 2.5-186.
Fire Protection Water Storage Tank (Fabritank) Floor and Dike	Abandoned. Fire protection water is supplied from Lake Erie. Sections 9A.5E.2.(d), 9A.5E.2.(f) and 9A.6 III.A; and Figures 1.2-2, 2.1-3, 2.4-3, 2.5-33, 2.5-48 and 2.5-186.
Fire and Security Training Facility	Used for Security and Fire training. Does not house any in-scope SSCs.
Fuel Oil Storage Tank Foundation	Supports the Auxiliary Boiler Fuel Oil Storage Tank, which is not in scope. Section 9A.4.9.3 and Figures 2.4-3, 2.5-186 and 9A-1.
Fuel Storage Depot, Unit 1	Vehicle refueling tanks in impoundments near the Unit 2 Cooling Tower. Sections 2.2.3.1.1.5 and 2.2.3.1.3.
Hydrogen Bulk Storage Foundation and Associated Structures, Unit 1	Provides hydrogen for main generator operation. Sections 9A.4.9.4, 9A.4.9.5.1, 10.2.5.1b, 10.2.5.2 and 10.2.5.3; and Figures 1.2-2, 9A-1 and 10.2-4.
Hydrogen Bulk Storage Foundation and Associated Structures, Unit 2	Abandoned, the Unit 2 bulk storage components have been removed. Figure 1.2-2.
Hydrogen Water Chemistry Hydrogen and Oxygen Tanks and related equipment supports	Provides hydrogen and oxygen for hydrogen water chemistry control and main generator operation. Outside of the protected area. Sections 2.2.3.1.1.6, 2.2.3.1.3, 9A.4.9.6, 10.2.5.1b and 10.2.5.3.
I&C Annex (Johnson Control Building)	Building has been removed, only the abandoned foundation pad remains at grade elevation. Figures 2.4-3 and 2.5-186.

Table 2.2-6
Structures and Structural Components
Not within the Scope of License Renewal

Structure Name	**Structure Function or UFSAR Reference**
Integrated Containment Management (ICM) staging and storage area and access road to the east of the Unit 1 Turbine Building in the yard area.	This area is to store sealants and boxes with the equipment which are mobilized through the Fuel Handling Building. This location is northeast of the service water swale. The ICM staging and storage area is 100' x 50' concrete pad. An access road connecting the ICM staging and storage pad to the existing roadway is also installed.
Industrial Waste Lagoons	Used for environmental controls. UFSAR Figures 1.2-2, 1.2-18, 2.1-3, 2.2-3, 2.4-3, 2.4-39, 2.4-39A, 2.5-33, 2.5-48, 2.5-186 and 9.5-7; and UFSAR Table 2.4-12.
Interim Shoreline Protection	Used to delay or preclude the need for permanent shoreline protection. Sections 2.4.5.5.2, 2.4.5.5.3 and 2.4.5.5.9; and Figures 2.4-39 and 2.4-39A.
Independent Spent Fuel Storage Installation (ISFSI) Facility	Provides temporary on-site spent fuel dry storage; licensed and operated in accordance with 10 CFR Part 72. Section 9.1.4.2.10.14 and Figures 1.2-2, 2.4-3 and 9A-1.
Low Level Radioactive Waste Building (LLRWSPF or WARF/RISB)	Used for temporary storage of low-level radioactive waste and radioactive material that may be reused. Sections 3.3.2.3, 9A.4.22.1 and 11.4.2.2; and Figures 1.2-2, 1.2-18, 2.4-3, 9.5-1 and 9A-1.
Main and Auxiliary Transformer Foundations	Provide support for the Unit 1 main and auxiliary transformers, which are not in scope for license renewal. The Unit 2 transformers have been removed. Section 9A.4.9.5.2 and Figures 1.2-2, 1.2-5, 1.2-12, 2.4-3 and 8.2-3.
Maintenance Building (Office and Shop)	Provides space for maintenance work, training, offices and storage. Figures 2.4-3, 2.4-39, 2.4-39A, 2.5-186 and 9.5-1.
Maintenance Building Annex	Provides space for maintenance work, training, offices and storage. Figures 2.4-3 and 9.5-1.
Major Stream Diversion Sediment Control Dam	Used for environmental controls. Sections 2.4.3.5 and 2.5.1.2.1.2; and Figures 1.2-18, 2.1-3, 2.4-6, 2.4-9, 2.4-11, 2.5-33, 2.5-53 and 2E-1.

Table 2.2-6
Structures and Structural Components
Not within the Scope of License Renewal

Structure Name	Structure Function or UFSAR Reference
Manholes, nonsafety-related (except electrical manhole 7)	Provide access to nonsafety-related underground utilities. Section 2.4.13.3 and Figure 2.4-3.
Meteorological Tower and Instrumentation Shelter	Sections 2.3.2.3.1, 2.3.3.1 and 2.3.3.4; and Figures 1.2-18, 2.1-3, 2.3-15, 2.4-9 (previous location).
Microwave Towers and Equipment Shelter	One provides communications capability, the other is abandoned. Figures 1.2-18, 2.1-3, 2.5-186, 2D-12 and 2E-1.
Minor Stream Diversion Sediment Control Dam	Used for environmental controls. Sections 2.4.3.5 and 2.5.1.2.1.2; and Figures 1.2-18, 2.1-3, 2.4-7, 2.4-8, 2.5-33, 2.5-53, 2D-16 and 2E-1.
Northwest Storm Drainage Sediment Control Dam	Used for environmental controls. Sections 2.4.5.5.7 and 2.5.1.2.1.2; and Figures 2.5-33, 2.5-53 and 2E-1.
Northwest Storm Impound Spillway	Used for environmental controls. Section 2.4.5.5.7 and Figure 2.4-39A.
On-Site Storage Container (OSSC) Storage Pad	Used for temporary storage of low-level radioactive waste. Figure 1.2-2.
Plant Access Road	Used for vehicle access to the plant site. Sections 2.1.1.3, 2.4.2.2, 2.4.2.3, 2.4.3.5 and 9.2.1.2; and Figures 1.2-18, 2.1-3, 2.4-3, 2.4-6, 2.4-9, 2.4-11, 2.5-33 and 2D-12.
Plant Railroad	Provides rail access to the plant site. Sections 2.1.2.1, 2.1.2.3, 2.2.1.3b, 2.2.2.b.2, 2.4.2.3, 3.8.4.1.3.1, 9.1.4.2.1 and 9.3.3.2.5; and Figures 1.2-18, 2.1-3, 2.2-2, 2.4-6, 2.5-33, 2D-12 and 9.1-26.
Pre-Access Facility	An administrative facility that is used for badging/plant access requirements. This facility does not house any in-scope SSCs.
Procedures and Records Building (Warehouse)	Provides document storage space and office space for support personnel. Figures 1.2-2, 2.4-3 and 2.5-186.
Quincy Substation	Supplies power to lighting and other non-essential loads. Figures 1.2-18, 2.1-3, 2-2.3, 2.4-9, 2.5.33 and 2D-12.

Table 2.2-6
Structures and Structural Components
Not within the Scope of License Renewal

Structure Name	Structure Function or UFSAR Reference
Service Building Annex	Provides office space for plant support personnel. Sections 9.2.1.2.5.a.6 and 9A.4.21, and Figures 1.2-2 and 9.5-1.
Service Water Pumphouse and Tunnel Intake Riser	Supports and shelters out-of-scope components. Sections 9.2.7.3, 9.4.10.2i (page 9.4-120), 9A.4.15 and 10.4.5.2; Figures 1.2-2, 1.2-15, 2.4-39, 2.4-39A, 2.4-69, 2.5-34, 2.5-36, 2.5-37, 2.5-49, 2.5-143 (Sheets 1 and 2), 2.5-186, 2.5-203, 2D-3, 2D-10, 2D-11, 2D-12, 2D-14, 3.8-65, 3.8-66, 3.8-70, 9.2-10, 9.2-14, 9.3-31 (Sheet 1), 9.4-27, 9.5-1, 9.5-22 (Sheets 1 and 3) and 9A-1; and Table 3.2-1 XXXIV 11.
Service Water Weir Box or Weir Structure	Controls makeup water to the cooling tower. Section 10.4.5.2 and Figures 1.2-2, 2.4-3, 2.5-186, 9.2-10, 9.2-14 and 9.5-22 (Sheets 1 and 3).
Sewage Treatment Plant	Used for environmental controls. Figures 1.2-2 and 2.5-186.
Concrete sidewalk (new) East of the Unit 2 heater bay, turbine building, steam tunnel, and auxiliary building [ECP 16-0491-001]	This new sidewalk created a permanent walkway for normal and outage travel. High outage traffic combined with winter/spring weather conditions results in unacceptable travel paths to trailers parked East of Unit 2 buildings.
Sodium Hypochlorite Tank Foundations and Containment Dikes	Abandoned. Originally for abandoned tanks 0P48A0001, 1P84A0001 and 2P84A0001. Figures 1.2-2, 1.2-5, 1.2-15 and 9.5-22 (sheet 3).
Spare Transformer Foundations	Spare transformers have no current plant functions. Section 9A.4.9.5.1 and Figures 1.2-5 and 2.4-3.
Tool Service Warehouse	Used for storage of maintenance materials and equipment. Located between the Unit 2 Cooling Tower and the ISFSI.
Transmission Station Control House	Contains electrical control and monitoring for switchyard circuit breakers.
Training Center (TC or TEC)	Provides space for the plant simulator and other training facilities. Section 9A.4.19; Figures 1.2-2, 9.5-1 and 9A-1; and Table 3.2-1 XLVIII.

Table 2.2-6
Structures and Structural Components
Not within the Scope of License Renewal

Structure Name	Structure Function or UFSAR Reference
Warehouse and Office Building	Provides equipment storage space and personnel office space. Figures 1.2-2, 1.2-18, 2.1-3, 2.2-3, 2.4-3, 2.5-186, 2D-12, 2E-1, 9.5-1 and 9.5-7.
Warehouse 2	Provides equipment storage space. Figure 9.5-1.
Warehouse 3	Provides equipment storage space. Figures 1.2-18, 2.1-3, 2.2-3, 2.5-33, 2.5-186, 2D-12, 2E-1 and 9.5-1.
Weld Shop	Welding facility that does not contain any in-scope SSC
Wooden Poles	Support nonessential lighting and electrical distribution.

2.3 SCOPING AND SCREENING RESULTS: MECHANICAL SYSTEMS

The license renewal scoping and screening results for PNPP mechanical systems are detailed in the following four sub-sections of Section 2.3:

- Reactor Vessel, Internals, and Reactor Coolant Systems [Section 2.3.1];
- Engineered Safety Features [Section 2.3.2];
- Auxiliary Systems [Section 2.3.3]; and,
- Steam and Power Conversion Systems [Section 2.3.4].

Specifically, this section provides the following information for the PNPP mechanical systems within the scope of license renewal listed in Table 2.2-1:

- The system description;
- A list of license renewal intended functions, including which criteria of 10 CFR 54 [Reference 1.3-1] require the system to be in-scope;
- Reference to the applicable PNPP UFSAR section(s);
- Reference to the applicable license renewal boundary drawing(s); and,
- A list of mechanical component types that are subject to an aging management review with their associated component intended function(s).

Table 2.3-1 gives the definitions of component intended functions used in this application for mechanical components. The term "piping" in component lists includes pipe and pipe fittings such as elbows, reducers, tees, thermowells, instrument tubing, and other fittings, and also includes instrument valves that do not appear on the highlighted scoping drawings.

Table 2.3-1
Mechanical Component Intended Functions: Abbreviations and Definitions

Intended Function	Definition
Absorb neutrons	Absorb neutrons to maintain the assumptions of criticality analyses for spent fuel storage.
Direct flow	Provide control of the distribution or direction of flow (e.g., spray nozzles, some reactor vessel internal components, curbs or dikes). Red highlighting is used on drawings.
Filtration	Provide filtration. Red highlighting is used on drawings.
Flow control	Control or distribute fluid flow. Red highlighting is used on drawings.

Table 2.3-1
Mechanical Component Intended Functions: Abbreviations and Definitions

Intended Function	Definition
Flow restriction	Provide a restriction to flow to limit flow rates or to provide a pressure difference (e.g., for flow measurement). Red highlighting is used on drawings.
Heat transfer	Provide for heat transfer. Red highlighting is used on drawings.
Leakage boundary	Nonsafety-related component that maintains mechanical and structural integrity to prevent spatial interactions that could cause failure of safety-related systems, structures and components. Blue highlighting on drawings for Leakage boundary includes the nonsafety "Structural integrity" function, where applicable.
Pressure boundary	Provide pressure-retaining boundary so that sufficient flow at adequate pressure is delivered; or, provide fission product barrier for containment pressure boundary; or, provide containment isolation for fission product retention. Additionally, for components such as ductwork and fire damper housings, the pressure boundary function includes providing a barrier to the spread of fires. This function is shown on drawings with red highlighting.
Radiation shielding	Provide radiation shielding to reduce neutron or gamma radiation fluence.
Spray	Containment spray removes heat from containment and serves as a containment atmosphere fission product removal mechanism following an accident. Red highlighting is used on drawings.
Structural integrity	Nonsafety-related component that maintains mechanical and structural integrity to provide structural support to attached safety-related piping and components. Green highlighting is used on drawings where nonsafety-related piping provides support to attached safety-related piping but does not perform a leakage boundary function (i.e., it contains air or gas, or is in an area for which the leakage boundary function is not applicable).
Structural support	Provide structural support to ensure system functions are maintained.

2.3.1 REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

The following systems are included in this section.

- Fuel [Section 2.3.1.1]
- Nuclear Boiler [Section 2.3.1.2]
- Reactor Coolant Pressure Boundary [Section 2.3.1.3]
- Reactor Recirculation [Section 2.3.1.4]
- Reactor Vessel [Section 2.3.1.5]
- Reactor Vessel Internals [Section 2.3.1.6]

2.3.1.1 Fuel (J11)

System Description

Each fuel bundle contains fuel rods and water rods which are spaced and supported in a square (nxn) array by spacers and a lower and upper tie plate. Fuel bundle design descriptions are contained in GESTAR. The fuel bundle has two important design features:

1) The bundle design places minimum external forces on a fuel rod; each fuel rod is free to expand in the axial direction.

2) The unique structural design permits the removal and replacement, if required, of individual fuel rods.

A fuel rod consists of UO2 pellets and a Zircaloy cladding tube. Barrier fuel bundles consist of fuel rods with a thin, high purity zirconium liner, i.e., barrier, mechanically bonded to the cladding tube. A fuel rod is made by stacking pellets into the Zircaloy cladding tube which is evacuated, back-filled with helium and sealed by welding Zircaloy end plugs in each end of the tube. The rod is designed to withstand applied loads, both external and internal. The fuel pellet is sized to provide sufficient clearance within the fuel tube to accommodate axial and radial differential expansion between fuel and clad.

During the refueling outage approximately one-third of the core is removed and replaced with an equal number of fresh or reinserted bundles.

The fuel bundle types installed in the core for the current cycle are of the same basic design as other approved designs in GESTAR.

System Boundary

There are no system components that are subject to aging management review.

The fuel is periodically replaced and is not long-lived.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event.

Fuel cladding provides a fission product barrier. [10 CFR 54.4(a)(1)]

Component Types Subject to Aging Management Review and their component-level functions

No components are subject to aging management review – the fuel is periodically replaced and is not long-lived.

Table 3.1.2-1, Reactor Vessel, Internals and Reactor Coolant Systems – Fuel System – Summary of Aging Management Evaluation, is included for completeness. There are no components subject to aging management review.

References

UFSAR References: 4.1.2.1.3; Appendix 15B

License Renewal Drawings: N/A

2.3.1.2 Nuclear Boiler (B21)

System Description

The nuclear boiler system (system code B21) includes the main steam lines and the nuclear pressure relief system and automatic depressurization system components from the main steam lines to the suppression pool. The system also includes other piping components such as vents, drains and instrument lines.

All the main steam system flow paths originate at one of the four 26-inch diameter steam lines that direct steam from the reactor pressure vessel. From the reactor vessel, the steam lines penetrate the Drywell and Containment via guard pipes. Each of the Main Steam Lines contains a flow restrictor. The Main Steam line flow restrictors are of the venturi-type and are installed in each Main Steam line inside the primary containment. The restrictors are designed to limit the loss of coolant resulting from a main steam line break outside the primary containment. The coolant loss is limited so that reactor vessel water level remains above the top of the core during the time required for the main steam line isolation valves to close.

The nuclear pressure relief system consists of safety/relief valves located on the main steam lines between the reactor vessel and the first isolation valve within the drywell. These valves protect against overpressure of the nuclear system. Each safety/relief valve discharges steam through a discharge line to a point below the minimum water level in the suppression pool.

The automatic depressurization system (ADS), a subsystem of B21, rapidly reduces reactor vessel pressure in a loss-of-coolant accident (LOCA) in which the HPCS system fails to maintain the reactor vessel water level. The depressurization provided by the system enables the low pressure emergency core cooling systems to deliver cooling water to the reactor vessel. The ADS uses some of the relief valves that are part of the nuclear pressure relief system within B21.

Two main steam isolation valves are welded in a horizontal run of each of the four main steam pipes; one valve is as close as possible to the inside of the drywell and the other is just outside the containment. Attached to the upper end of the stem is an air cylinder that opens and closes the valve and a hydraulic dashpot that controls its speed. Normal operating air is supplied to the valves from the nonsafety-related plant instrument air system.

System Boundary

System components subject to aging management review include non-Class 1 components associated with the main steam lines from the reactor vessel to, and including the outside containment isolation valves, and the components associated with the main steam safety/relief valves and their discharge piping, along with piping components and valves supporting instrumentation associated with systems connected to the reactor vessel, as shown on the LR boundary drawings. The system contains the Class 1 piping attached to the head vent/RCIC penetration, but all ASME Class 1 components are evaluated within the Reactor Coolant Pressure Boundary report.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event and because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection (FP), environmental qualification (EQ), anticipated transients without scram (ATWS), and station blackout (SBO). The system also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1), (a)(3) – SBO]

Provide a relief path for steam in the event of a reactor overpressure condition. [10 CFR 54.4(a)(1), (a)(3) – FP, SBO]

Provide system isolation in the event of a steam line break in order to minimize the release of radioactive fission products to the environment. [10 CFR 54.4(a)(1)]

The pressure relief system is designed to automatically relieve pressure in the reactor vessel. [10 CFR 54.4(a)(1), (a)(3) – FP]

System instrumentation supports ESF and ATWS actuations and isolations. [10 CFR 54.4(a)(1), (a)(3) – ATWS].

Provide steam supply to the Reactor Core Isolation Cooling turbine driven pump. [10 CFR 54.4(a)(1), (a)(3) – FP]

The system contains components credited with compliance with 10 CFR 50.49 [Reference 1.3-7]. [10 CFR 54.4(a)(3) – EQ]

The integrity of nonsafety-related components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Direct steam flow to the Main Turbine and selected support equipment.

Component Types Subject to Aging Management Review

Table 2.3.1-2 lists the component types that require aging management review and their intended functions.

Table 3.1.2-2, Reactor Vessel, Internals and Reactor Coolant Systems – Nuclear Boiler System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.1-2
Nuclear Boiler
Component Types Subject to Aging Management Review

Component Type	Intended function
Accumulator	Pressure boundary
Bolting	Leakage boundary, Pressure boundary
Flexible hose	Pressure boundary
Filter housing	Leakage boundary
Orifice	Flow restriction, Pressure boundary, Leakage boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
SRV Discharge Quencher	Pressure boundary
Strainer body	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR References: 1.2.2.4.8.b; 5.1; 5.4.4; 5.4.5.2; 5.4.9.2; 5.2.2.4.1; 6.2.4.2.2.1.b; 6.3.1.2.4; 6.3.2.2.2; 10.1; Appendix 3BA, Appendix 15C; Appendix 15H

License Renewal Drawings: 302-0121; 302-0605; 302-0606; 302-0607

2.3.1.3 Reactor Coolant Pressure Boundary (RCPB)

System Description

This system is a consolidation of the ASME III Class 1 portions of plant systems other than the reactor vessel and internals. UFSAR Section 5.1 defines the Reactor Coolant Pressure Boundary to include all pressure-containing components such as pressure vessels, piping, pumps, and valves, which are:

a. Part of the reactor coolant system, or

b. Connected to the reactor coolant system, up to and including any and all of the following:

- The outermost containment isolation valve in piping which penetrates primary reactor containment.
- The second of the two valves normally closed during normal reactor operation in system piping which does not penetrate primary reactor containment.
- The reactor coolant system safety/relief valve piping.

The Reactor Coolant Pressure Boundary includes portions of the following plant systems:

B13 Reactor Vessel (reactor vessel drain line and control rod drive)

B21 Nuclear Boiler

B33 Reactor Recirculation

C41 Standby Liquid Control System

E12 Residual Heat Removal (the RHR system reactor coolant pressure boundary ends within containment for two lines that supply containment spray)

E21 Low Pressure Core Spray System

E22 High Pressure Core Spray System

E51 Reactor Core Isolation Cooling

G33 Reactor Water Cleanup

N27 Feedwater

System Boundary

System components subject to aging management review are the ASME III Class 1 components, other than the reactor vessel and internals components, as shown on the LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP and EQ.

The reactor coolant pressure boundary contains the coolant under operating temperature and pressure conditions and limits leakage and the release of fission products. [10 CFR 54.4(a)(1), (a)(3) – (FP)]

Provide system isolation in the event of a piping break in order to minimize the release of radioactive fission products to the environment. [10 CFR 54.4(a)(1)]

The system contains components credited with compliance with 10 CFR 50.49 [Reference 1.3-7]. [10 CFR 54.4(a)(3) – (EQ)]

Other functions associated with systems comprising the reactor coolant pressure boundary are listed with the specific system.

Component Types Subject to Aging Management Review

Table 2.3.1-3 lists the component types that require aging management review and their intended functions.

Table 3.1.2-3, Reactor Vessel, Internals and Reactor Coolant Systems – Reactor Coolant Pressure Boundary System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.1-3
Reactor Coolant Pressure Boundary
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Condensing chamber	Pressure boundary
Control rod drive	Pressure boundary
Flow restrictor	Pressure boundary, Flow restriction
Flow restrictor (Main steam - Body)	Pressure boundary
Flow restrictor (Main steam - Venturi)	Flow restriction
Heat exchanger (Recirc pump seal cooler)	Pressure boundary
Piping (Class 1) < NPS 4	Pressure boundary
Piping (Class 1) >= NPS 4	Pressure boundary
Pump casing	Pressure boundary
Valve body	Pressure boundary

References

UFSAR References: 5.1; 6.2.4.2.2.1

License Renewal Drawings: 302-0082; 302-0121; 302-0601; 302-0602; 302-0605; 302-0606; 302-0613; 302-0631; 302-0632; 302-0642; 302-0671; 302-0672; 302-0691; 302-0701; 302-0705

2.3.1.4 Reactor Recirculation (B33)

System Description

The reactor recirculation system consists of two recirculation pump loops external to the reactor vessel. These loops provide the piping path for the driving flow of water to the reactor vessel jet pumps. Each external loop contains one high capacity two-speed motor-driven recirculation pump, two motor-operated maintenance valves and one hydraulically operated flow control valve. The variable position hydraulic flow control valve operates in conjunction with a low frequency motor-generator set to control reactor power level through the effects of coolant flow rate on moderator void content. The low frequency motor-generator source is only used to power the recirculation pumps at low power. When reactor power is greater than approximately 20-28 percent of rated, the recirculation pumps are switched to the 100 percent speed power source.

The jet pumps are part of the reactor vessel internals. The jet pumps provide a continuous internal circulation path for the major portion of the core coolant flow. The jet pumps are mounted in the annular region between the core shroud and the vessel inner wall. Any recirculation line break would still allow core flooding to approximately two-thirds of the core height (the level of the inlet of the jet pumps).

System Boundary

System components subject to aging management review include nonsafety-related hydraulic pumps, valves, tanks, and piping components associated with the reactor recirculation valve actuators, and safety-related valves and piping components associated with reactor recirculation instrumentation.

The jet pump assemblies and associated components internal to the reactor vessel are evaluated with the Reactor Vessel Internals system (B13b). The ASME Class 1 components of the system external to the reactor vessel are evaluated with the Reactor Coolant Pressure Boundary (RCPB).

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP and EQ.

Reactor recirculation provides forced circulation through the core to achieve full power operation and allows power to be varied without movement of the control rods.

Flow Control Valves (FCVs) Hydraulic Power Units maintain the associated reactor recirculation flow control valve available for operation. Both subloops auto shift to the Maintenance Mode and lock-up the FCVs when specific abnormal conditions are detected.

The system contains safety-related indication. [10 CFR 54.4(a)(1), (a)(3) – EQ]

Reactor Recirculation Reactor Coolant Pressure Boundary. [10 CFR 54.4(a)(1), (a)(3) – FP] (ASME Class 1 components are evaluated with the Reactor Coolant Pressure Boundary section)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Table 2.3.1-4 lists the component types that require aging management review and their intended functions.

Table 3.1.2-4, Reactor Vessel, Internals and Reactor Coolant Systems – Reactor Recirculation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.1-4
Reactor Recirculation
Component Types Subject to Aging Management Review

Component Type	Intended function
Accumulator	Leakage boundary
Bolting	Leakage boundary, Pressure boundary
Filter housing	Leakage boundary
Flexible hose	Pressure boundary
Heat exchanger (Oil cooler header)	Leakage boundary
Heat exchanger (Oil cooler tube)	Leakage boundary
Orifice	Pressure boundary, Flow restriction
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Sight glass	Leakage boundary
Sight glass (Body)	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR References: 1.2.2.3.3, 4.4.3.3.1, 5.4.1.3, Appendix 15C

License Renewal Drawings: 302-0600, 302-0601, 302-0602, 302-0603, 302-0604

2.3.1.5 Reactor Vessel (RXV)

System Description

The reactor vessel contains the core and supporting structures. The main connections to the vessel include steam lines, coolant recirculation lines, feedwater lines, control rod drive and in-core nuclear instrument housings, core spray lines, RHR/LPCI line, core differential pressure line, jet pump pressure sensing lines, and water level instrumentation lines.

The reactor vessel is a vertical, cylindrical pressure vessel of welded construction. The vessel top head is secured to the reactor vessel by studs and nuts. The vessel flanges are sealed with two concentric metal seal-rings designed to permit no detectable leakage through the inner or outer seal at any operating condition.

System Boundary

System components subject to aging management review include the reactor vessel and attached brackets and welds, vessel head, studs, nuts, support skirt, nozzles, safe ends, and welds are evaluated within this section. This scope comprises the components with functional location identifiers for the Reactor and Internals system with the following exceptions/clarifications:

- The components internal to the reactor vessel are evaluated with the Reactor Vessel Internals system.
- The vessel closure head o-rings are within the scope of license renewal, but are periodically replaced, and are not subject to aging management.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulation for FP.

The reactor vessel serves as a pressure boundary for containing the coolant under operating temperature and pressure conditions and for limiting leakage and the release of fission products. [10 CFR 54.4(a)(1), (a)(3) – FP]

The reactor vessel provides structural support for the vessel internals and fuel to maintain core geometry. [10 CFR 54.4(a)(1)]

Component Types Subject to Aging Management Review

Table 2.3.1-5 lists the component types that require aging management review and their intended functions.

Table 3.1.2-5, Reactor Vessel, Internals and Reactor Coolant Systems – Reactor Vessel System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.1-5
Reactor Vessel
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting (Vessel nozzle flanges)	Pressure boundary
Control rod drive housing	Pressure boundary
Core spray bracket and weld	Structural support
Dryer hold-down bracket and weld	Structural support
Dryer support bracket and weld	Structural support
Feedwater sparger bracket and weld	Structural support
Guide rod bracket and weld	Structural support
Head closure studs, nuts, washers	Pressure boundary
Incore housing	Pressure boundary
Jet pump riser brace and weld	Structural support
Nozzle and safe end welds	Pressure boundary
Nozzle safe ends	Pressure boundary
Nozzle thermal sleeves	Pressure boundary
Specimen bracket and weld	Structural support
Support skirt	Structural support
Vessel bottom head	Pressure boundary
Vessel nozzle (Capped control rod drive return)	Pressure boundary
Vessel nozzle (Core D/P)	Pressure boundary
Vessel nozzle (Core spray)	Pressure boundary
Vessel nozzle (Feedwater)	Pressure boundary
Vessel nozzle (Low pressure coolant injection/RHR)	Pressure boundary
Vessel nozzle (Main steam, Head vent, Drain, Vibration instrumentation)	Pressure boundary
Vessel nozzle (Recirc in / out)	Pressure boundary
Vessel nozzle (Seal leak)	Pressure boundary
Vessel nozzle (Water level instrumentation)	Pressure boundary
Vessel shell (Beltline plates and welds)	Pressure boundary
Vessel shell (Closure flange and welds)	Pressure boundary

Component Type	Intended function
Vessel shell (Non-beltline plates and welds)	Pressure boundary
Vessel upper head (Closure flange)	Pressure boundary
Vessel upper head (Dome)	Pressure boundary

References

UFSAR References: 1.2.2.3.2; 3.2.3.2; 5.3.3.1.1.1; Figure 5.3-6

License Renewal Drawings: None

2.3.1.6 Reactor Vessel Internals (RVI)

System Description

The major reactor internal components are the core (fuel, channels, control blades, and instrumentation), the core support structure (including the shroud, top guide and core plate), the shroud head and steam separator assembly, the steam dryer assembly, the feedwater spargers, the core spray spargers, and the jet pumps.

The floodable inner volume of the reactor pressure vessel is the volume inside the core shroud up to the level of the jet pump suction inlet. The design arrangement of the reactor internals, such as the jet pumps, steam separators and guide tubes, is such that one end is unrestricted and thus free to expand. The LPCI couplings incorporate vertically oriented slip fit joints to allow free thermal expansion.

The core support structures and reactor vessel internals (exclusive of fuel, control rods and incore nuclear instrumentation) are identified below.

Core Support Structures

These structures form partitions within the reactor vessel, to sustain pressure differentials across the partitions, direct the flow of the coolant water and laterally locate and support the fuel assemblies.

a. Shroud

The shroud support, shroud and top guide make up a stainless steel cylindrical assembly that provides a partition to separate the upward flow of coolant through the core from the downward recirculation flow. This partition separates the core region from the downcomer annulus, thus providing a floodable region following a recirculation line break. The volume enclosed by this assembly is characterized by three regions. The upper portion surrounds the core discharge plenum, which is bounded by the shroud head on top and the top guide's grid plate below. The central portion of the shroud surrounds the active fuel and forms the longest section of the assembly. This section is bounded at the top by the grid plate and at the bottom by the core plate. The lower portion, surrounding part of the lower plenum, is welded to the reactor pressure vessel shroud support.

b. Shroud Support

The shroud support is designed to support the shroud and to support and locate the jet pumps. The shroud support provides an annular baffle between the reactor pressure vessel and the shroud. The jet pump discharge diffusers penetrate the shroud support to introduce coolant to the inlet plenum below the core.

c. Shroud Head and Steam Separator Assembly

This component is not a core support structure or safety class component. It is discussed here to describe the coolant flow paths in the reactor pressure vessel. The shroud head and steam separator assembly is bolted to the top of the top guide to form the top of the core discharge plenum. This plenum provides a mixing chamber for the steam-water mixture before it enters the steam separators. Individual stainless steel axial flow steam separators are attached to the top of standpipes that are welded into the shroud head. The steam separators have no moving parts. In each separator, the steam-water mixture rising through the standpipe passes vanes that impart a spin to establish a vortex separating the water from the steam. The separated water flows from the lower portion of the steam separator into the downcomer annulus.

d. Core Plate

The core plate consists of a circular stainless steel plate with bored holes stiffened with a rim and beam structure. The plate provides lateral support and guidance for the control rod guide tubes, in-core flux monitor guide tubes, peripheral fuel supports, and startup neutron sources. The last two items are also supported vertically by the core support plate. The entire assembly is bolted to a support ledge on the lower portions of the shroud.

e. Top Guide

The top guide consists of a circular grid plate with square openings welded to the bottom of the top guide cylinder. Each opening provides lateral support and guidance for four fuel assemblies, or in the case of peripheral fuel, less than four fuel assemblies. Notches are provided in the bottom of the intersections to anchor the in-core flux monitors and startup neutron sources. The top guide is bolted to the shroud. The core spray spargers are installed in the upper portion of the top guide cylinder.

f. Fuel Support

The fuel supports are of two basic types: peripheral supports and four-lobed orificed fuel supports. The peripheral fuel support is located at the outer edge of the active core and is not adjacent to control rods. Each peripheral fuel support will support one fuel assembly and contains a single orifice assembly designed to assure proper coolant flow to the peripheral fuel assembly. Each four-lobed orificed fuel support will support four fuel assemblies and is provided with four orifice plates to assure proper coolant flow distribution to each rod-controlled fuel assembly. The four-lobed orificed fuel supports rest in the top of the control rod guide tubes which are supported laterally by the core plate. The control rods pass through slots in the center of the four-lobed orificed fuel support. A control rod and the four adjacent fuel assemblies represent a core cell.

g. Control Rod Guide Tubes

The control rod guide tubes, located inside the vessel, extend from the top of the control rod drive housings up through holes in the core plate. Each tube is designed as the guide for a control rod and as the vertical support for a four-lobed orificed fuel support piece and the four fuel assemblies surrounding the control rod. The bottom of the guide tube is supported by the control rod drive housing, which in turn transmits the weight of the guide tube, fuel support and fuel assemblies to the reactor vessel bottom head. A thermal sleeve is inserted into the control rod drive housing from below and is rotated to lock the control rod guide tube in place. A key is inserted into a locking slot in the bottom of the control rod drive housing to hold the thermal sleeve in position.

Reactor Internals

a. Jet Pump Assemblies

The jet pump assemblies are not core support structures but are discussed here to describe coolant flow paths in the vessel. The jet pump assemblies are located in two semi-circular groups in the downcomer annulus between the core shroud and the reactor vessel wall. Each stainless steel jet pump consists of driving nozzles, suction inlet, throat or mixing section, and diffuser. The driving nozzle, suction inlet and throat are joined as a removable unit, and the diffuser is permanently installed. High pressure water from the recirculation pumps is supplied to each pair of jet pumps through a riser pipe welded to the recirculation inlet nozzle thermal sleeve. A riser brace consists of cantilever beams welded to a riser pipe and to pads on the reactor vessel wall. The nozzle entry section is connected to the riser by a metal-to-metal, spherical-to-conical seal joint. Firm contact is maintained by a hold-down clamp. The throat section is supported laterally by a bracket attached to the riser. There is a slip-fit joint between the throat and diffuser. The diffuser is a gradual conical section changing to a straight cylindrical section at the lower end.

b. Steam Dryer

The steam dryer assembly is not a core support structure or safety class component. It is discussed here to describe coolant flow paths in the vessel. The steam dryers remove moisture from the wet steam leaving the steam separators. The extracted moisture flows down the dryer vanes to the collecting troughs, then flows through tubes into the downcomer annulus. A skirt extends from the bottom of the dryer vane housing to the steam separator standpipe, below the water level. This skirt forms a seal between the wet steam plenum and the dry steam flowing from the top of the dryers to the steam outlet nozzles. The steam dryer and shroud head are positioned in the vessel during installation with the aid of vertical guide rods. The dryer assembly rests on steam dryer support brackets attached to the reactor vessel wall. Upward movement of the dryer assembly, which may occur under accident conditions, is restricted by steam dryer hold-down brackets attached to the reactor vessel top head.

c. Feedwater Spargers

These components are not core support structures or safety class components. They are discussed here to describe flow paths in the vessel. The feedwater spargers are stainless steel headers located in the mixing plenum above the downcomer annulus. A separate sparger is fitted to each feedwater nozzle and is shaped to conform to the curve of the vessel wall. Sparger end brackets are pinned to vessel brackets to support the spargers. Feedwater flow enters the center of the spargers and is discharged radially inward to mix the cooler feedwater with the downcomer flow from the steam separators and steam dryer before it contacts the vessel wall. The feedwater also serves to condense the steam in the region above the downcomer annulus and to sub-cool the water flowing to the jet pumps and recirculation pumps.

d. Core Spray Lines and Liquid Control Line

These components are not core support structures. They are discussed here to describe safety class features inside the reactor pressure vessel. The core spray lines are the means for directing flow to the core spray nozzles which distribute coolant during accident conditions. The core spray line associated with the high pressure core spray system also serves as the liquid control line for providing a path for liquid control solution injection. Two core spray lines enter the reactor vessel through the two core spray nozzles. The lines divide immediately inside the reactor vessel. The two halves are routed to opposite sides of the reactor vessel and are supported by clamps attached to the vessel wall. The lines are then routed downward into the downcomer annulus and pass through the top guide cylinder immediately below the flange. The flow divides again as it enters the center of the semicircular sparger, which is routed halfway around the inside of the top guide cylinder. The two spargers are supported by brackets designed to accommodate thermal expansion. The line routing and supports are designed to accommodate differential movement between the top guide and vessel. The other core spray line is identical except that it enters the opposite side of the vessel, and the spargers are at a slightly different elevation inside the top guide cylinder. The correct spray distribution pattern is provided by a combination of distribution nozzles pointed radially inward and downward from the spargers. Use of the HPCS spray line for liquid control solution injection facilitates good mixing and dispersion.

e. Vessel Head Spray Nozzle

This component is not a core support structure. It is included here to describe a safety class feature in the reactor pressure vessel that receives flow from the RCIC system, or can be aligned to receive flow from the RHR system, when those systems are in operation. When reactor coolant is returned to the reactor vessel, part of the flow can be diverted to a spray nozzle in the reactor head. This spray maintains saturated conditions in the reactor vessel head volume by condensing steam being generated by the hot reactor vessel walls and internals. The spray also decreases thermal stratification in the reactor vessel coolant. This ensures that the water level in the reactor vessel can rise. The higher water level provides conduction cooling to more of the mass of metal of the reactor vessel and, therefore, helps to maintain the cooldown rate. The vessel head spray nozzle is mounted to a short length of pipe and a flange, which is bolted to a mating flange on the reactor vessel head nozzle.

f. Differential Pressure Sensing Lines

These components are not core support structures or safety class components. The differential pressure lines enter the vessel through two bottom head penetrations and sense the differential pressure across the core support plate. One line terminates near the lower shroud with a perforated length below the core support plate to sense the pressure in that region. The other line terminates immediately above the core support plate and senses the pressure in the region outside the fuel assemblies.

g. In-Core Flux Monitor Guide Tubes

This component is not a core support structure. They provide a means of positioning fixed detectors in the core as well as provide a path for calibration monitors (TIP System). The in-core flux monitor guide tubes extend from the top of the in-core flux monitor housing in the lower plenum to the top of the core support plate. The power range detectors for the power range monitoring units and the dry tubes for the source range monitoring and intermediate range monitoring (SRM/IRM) detectors are inserted through the guide tubes. A latticework of clamps, tie bars and spacers give lateral support and rigidity to the guide tubes. The bolts and clamps are welded, after assembly, to prevent loosening during reactor operation.

h. Surveillance Sample Holders

This component is not a core support structure or a safety class component. The surveillance sample holders are welded baskets containing impact and tensile specimen capsules. The baskets hang from the brackets that are attached to the inside wall of the reactor vessel and extend to mid-height of the active core. The radial positions are chosen to expose the specimens to the same environment and maximum neutron fluxes experienced by the reactor vessel itself while avoiding jet pump removal interference or damage.

i. Low Pressure Coolant Injection (LPCI) Lines

This component is not a core support structure but is discussed here to describe the coolant flow paths in the reactor vessel. Three LPCI lines penetrate the core shroud through separate LPCI nozzles. Coolant is discharged inside the core shroud.

System Boundary

Components within the reactor vessel are evaluated within this system. This scope comprises the components with functional location identifiers for the Reactor and Internals system with the following exceptions/clarifications:

- The reactor vessel, vessel head, studs, nuts, CRD housing nozzles, safe ends, and welds are evaluated within the Reactor Vessel system. Additionally, non-Class I components of the control rod drive system external to the reactor vessel are evaluated within the Reactor Vessel system.
- The fuel assemblies and control rod assemblies are in scope for license renewal; however, they are short-lived components and are therefore not subject to aging management review. Fuel assemblies are further evaluated in the J11 System Scoping

Report. The following Reactor Vessel Internals components are not required to support intended functions and are not included within the scope of license renewal; the feedwater sparger, the shroud head and steam separator assemblies and guide rods, core plate differential sensing lines, and the surveillance sample holders. A safety assessment for these components has been documented in BWRVIP-06-A. The evaluation concluded that these components do not perform a safety related function. This report also concluded that failure of these components does not result in consequential failure of any safety-related equipment, including the potential effects of loose parts. The steam dryer is also nonsafety-related, but the safety assessment for this component credited inspections which would identify cracking before gross failure. Therefore, the steam dryer will be subject to aging management.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, perform a function that demonstrates compliance with the Commission's regulations for anticipated transients without scram (ATWS), and EQ, and because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The reactor vessel serves as a pressure boundary for containing the coolant under operating temperature and pressure conditions and for limiting leakage and the release of fission products. [10 CFR 54.4(a)(1)]

The reactor vessel provides a floodable volume in which the core can be adequately cooled in the event of a breach in the reactor coolant pressure boundary external to the reactor vessel. [10 CFR 54.4(a)(1)]

The reactor vessel internal components provide structural support of internals and fuel to maintain core geometry [10 CFR 54.4(a)(1)]

Reactor vessel internal components establish flow paths within the vessel to support removal of heat from the fuel and providing a path for liquid control solution injection. [10 CFR 54.4(a)(1), (a)(3) ATWS, EQ]

Failure of non-safety internal components could adversely affect flow paths within the vessel [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

Table 2.3.1-6 lists the component types that require aging management review and their intended functions.

Table 3.1.2-6, Reactor Vessel, Internals and Reactor Coolant Systems – Reactor Vessel Internals System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.1-6
Reactor Vessel Internals
Component Types Subject to Aging Management Review

Component Type	**Intended function**
Bolting (Core support plate, Top guide)	Structural support
Control rod guide tube	Structural support
Control rod guide tube (Thermal sleeve)	Structural support
Core plate assembly	Structural support
Core shroud	Flow control, Structural support
Core shroud (access hole cover)	Flow control, Structural support
Core shroud support	Flow control, Structural support
Core spray lines, spargers and spray nozzles	Flow control
Dry tube assembly	Pressure boundary
Head spray nozzle	Flow control
Incore guide tube	Structural support
Incore guide tube stabilizer	Structural support
Jet pump (Bolting)	Flow control, Structural support
Jet pump (Bracket restrainer)	Structural support
Jet pump (Diffuser adaptor)	Flow control, Structural support
Jet pump (Diffuser)	Flow control, Structural support
Jet pump (Hold-down beam)	Structural support
Jet pump (Mixer assembly)	Flow control, Structural support
Jet pump (Nozzle assembly)	Flow control, Structural support
Jet pump (Riser pipe, elbow, brace)	Flow control, Structural support
Jet pump (Thermal sleeve)	Flow control, Structural support
Jet pump (Transition piece)	Flow control, Structural support
Jet pump (Wedge)	Structural support
Low pressure coolant injection flow deflector	Flow control
Low pressure coolant injection lines	Flow control
Low pressure coolant injection lines (Castings)	Flow control

Component Type	**Intended function**
Orificed fuel support	Flow control, Structural support
Peripheral fuel support	Flow control, Structural support
Peripheral fuel support orifice	Flow control
Shroud head bolt assembly	Structural support
Steam dryer	Structural support
Top guide assembly	Structural support

References

UFSAR References: 3.2.3.2; 3.9.5.1; 4.1.2

License Renewal Drawings: None

2.3.2 ENGINEERED SAFETY FEATURES SYSTEMS

The following systems are included in this section:

- Alternate Decay Heat Removal [Section 2.3.2.1]
- Annulus Exhaust Gas Treatment [Section 2.3.2.2]
- Containment Atmosphere Monitoring [Section 2.3.2.3]
- High Pressure Core Spray [Section 2.3.2.4]
- Low Pressure Core Spray [Section 2.3.2.5]
- Offgas [Section 2.3.2.6]
- Reactor Core Isolation Cooling [Section 2.3.2.7]
- Residual Heat Removal and Containment Spray [Section 2.3.2.8]
- Suppression Pool [Section 2.3.2.9]

2.3.2.1 Alternate Decay Heat Removal (G40)

System Description

The alternate decay heat removal (ADHR) system is a nonsafety-related, seismic Category I system. The ADHR system is designed to provide additional decay heat removal options through a nonsafety-related alternate decay heat removal system that can be used in MODE 4 and MODE 5 with the reactor depressurized and reactor coolant system temperature less than or equal to 200°F. The system is designed to remove the decay heat load that exists approximately 24 hours after plant shutdown from 100% power.

The system consists of an ADHR heat exchanger and pump, suction and return lines with tie-ins to the low pressure core spray (LPCS) system, residual heat removal (RHR) system, and condensate transfer and storage (CTS) system with the associated piping, valves, instrumentation and appurtenances. The cooling water for the ADHR heat exchanger is provided by the Service Water (SW) system. The ADHR system is limited to a heat removal rate corresponding to the decay heat production rate of the core 24 hours after a scram from sustained 100% power. Once the plant has been shut down for 24 hours or greater, is in MODE 4 or 5 and the reactor is depressurized, ADHR may be placed in service.

The ADHR system is nonsafety-related and is not required for the safe shutdown of the reactor. However, portions of the piping and valves in the ADHR system that are within the ASME boundaries of the RHR system and the LPCS system are safety-related.

System Boundary

System components subject to aging management review include a pump, heat exchanger, valves and other piping components, as shown on LR boundary drawings.

The radiation monitor for ADHR is evaluated as part of the plant radiation monitoring system (System D17).

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

1. System piping components support integrity of safety-related interfacing systems. [10 CFR 54.4(a)(1)]
2. The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]
3. Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]
4. Provide additional decay heat removal options in Modes 4 and 5.
5. Provide additional injection into the Reactor Pressure Vessel when Low Pressure Core Spray is unavailable to maintain adequate core cooling.
6. Provide additional cooling of the Suppression Pool when Residual Heat Removal is unavailable.

Component Types Subject to Aging Management Review

Table 2.3.2-1 lists the component types that require aging management review and their intended functions.

Table 3.2.2-1, Engineered Safety Features Systems – Alternate Decay Heat Removal System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-1
Alternate Decay Heat Removal
Component Types Subject to Aging Management Review

Component Type	**Intended function**
Bolting	Leakage boundary, Pressure boundary
Heat exchanger (Plate)	Leakage boundary
Orifice	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary

Component Type	Intended function
Valve body	Leakage boundary, Pressure boundary

References

UFSAR References: 9.2.10.1, 9.2.10.2, 9.2.10.3, Table 3.2-1 notes

License Renewal Drawings: 302-0246

2.3.2.2 Annulus Exhaust Gas Treatment (M15)

System Description

The annulus exhaust gas treatment system (AEGTS) processes the ambient air in the annular space between the shield building and the primary containment vessel to limit the release to the environment of radioisotopes which may leak from the primary containment under accident conditions.

The annulus exhaust gas treatment system consists of two redundant subsystems designed to filter any airborne radioactive iodine and particulates from the air which leak out of the containment vessel. Each subsystem (consisting of a 100 percent capacity exhaust fan, roughing, HEPA, and charcoal filters) exhausts to the plant vent.

This system is Safety Class 2 and functions continuously during normal, shutdown and refueling operations, during loss of offsite power periods and following a LOCA to maintain a negative pressure differential between the containment vessel annulus and the outside.

System Boundary

System components subject to aging management review include fan housings, filter housings, damper housings and other ductwork components in the reactor building annulus, and in the intermediate building, as shown on the LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP and EQ.

AEGTS maintains the annulus space between shield building and containment vessel at a negative pressure. Processes the ambient air in the annular space between the shield building and the primary containment vessel to limit the release to the environment of radioisotopes which may leak from the primary containment under accident conditions. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Ventilation ducts penetrating the shield building wall are provided with fire dampers to limit the spread of fires. [10 CFR 54.4(a)(3) – FP]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ].

Component Types Subject to Aging Management Review

Table 2.3.2-2 lists the component types that require aging management review and their intended functions.

Table 3.2.2-2, Engineered Safety Features Systems – Annulus Exhaust Gas Treatment System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-2
Annulus Exhaust Gas Treatment
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary, Filtration
Flexible connection	Pressure boundary
Flow element	Pressure boundary
Piping	Leakage boundary, Pressure boundary
Valve body	Pressure boundary

References

UFSAR References: 1.2.2.4.16, 6.5.3.2, 9A.4.1.1

License Renewal Drawings: 912-0605

2.3.2.3 Containment Atmosphere Monitoring (D23)

System Description

The containment atmospheric monitoring system provides instrumentation for detecting and predicting the progression of abnormal occurrences in the containment and for monitoring after postulated accidents. Containment and Drywell temperature, pressure and differential pressure monitoring is provided by instrumentation and alarms. The system also provides suppression pool temperature monitoring instrumentation and Containment humidity instrumentation.

System Boundary

System components subject to aging management review include safety-related instrument sensing piping, orifices and valves, as shown on the LR boundary drawing.

The piping penetrating the containment is evaluated as "piping," with the structural penetration components evaluated as civil components. The protection tubes associated with suppression pool temperature elements are evaluated as civil components.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Provides indication of Drywell pressure and temperature, Containment pressure and temperature, Containment/Drywell differential pressure, suppression pool temperature, and sample line isolation valve position. [10 CFR 54.4(a)(1)]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Component Types Subject to Aging Management Review

Table 2.3.2-3 lists the component types that require aging management review and their intended functions.

Table 3.2.2-3, Engineered Safety Features Systems–Containment Atmosphere Monitoring System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-3
Containment Atmosphere Monitoring
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Orifice	Flow restriction
Piping	Pressure boundary
Valve body	Pressure boundary

References

UFSAR: 7.1.1.n, 7.6.1.8

License Renewal Drawings: 302-0881

2.3.2.4 High Pressure Core Spray (E22)

System Description

The high pressure core spray (HPCS) system provides and maintains an adequate coolant inventory inside the reactor vessel to limit fuel cladding temperatures in the event of breaks in the reactor coolant pressure boundary. The system is initiated by either high pressure in the drywell or low water level in the vessel. It operates independently of all other systems over the entire range of pressure differences from greater than normal operating pressure to zero. Suction piping is provided from the condensate storage tank and the suppression pool. The standby liquid control system discharges into the Reactor Vessel via HPCS piping and the HPCS spargers. The suppression pool cleanup system takes its suction from the HPCS suppression pool suction line.

The pump discharge line is maintained full by a jockey pump that takes suction from the HPCS pump suction line and discharges downstream of the check valves on the HPCS pump discharge line.

System Boundary

System components subject to aging management review include a single motor-driven centrifugal pump and associated system piping, valves, controls, and instrumentation as shown on LR boundary drawings. The HPCS pump seal water cyclone separator and associated piping are not shown on LR boundary drawings but are within scope.

The ASME Class 1 piping components in the system are evaluated with the Reactor Coolant Pressure Boundary System, and the piping and spray sparger in the reactor vessel are evaluated with the Reactor Vessel Internals System. The HPCS diesel generator is evaluated with the Division 1 and 2 diesel generators.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ, ATWS, and SBO.

Spray coolant into the reactor vessel to mitigate accidents. This system along with the other ECCS systems satisfy the requirements of 10 CFR 50.46. [10 CFR 54.4(a)(1), (a)(3) - ATWS]

Containment isolation valves limit radiological release. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

The system is used as the means for removing decay heat following a Station Blackout event. [10 CFR 54.4(a)(3) – SBO]

Component Types Subject to Aging Management Review

Table 2.3.2-4 lists the component types that require aging management review and their intended functions.

Table 3.2.2-4, Engineered Safety Features Systems – High Pressure Core Spray System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-4
High Pressure Core Spray
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Cyclone separator	Filtration, Pressure boundary
Flexible hose	Leakage boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary

Component Type	Intended function
Piping	Leakage boundary, Pressure boundary
Pump casing	Pressure boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 1.2.2.4.8.a, Table 6.1-1, 6.3.1.1.1, 6.3.2.2.1, 6.3.2.2.5, 9.3.5.2, Appendix 15C, Appendix 15H.2.2

License Renewal Drawings: 302-0574, 302-0701

2.3.2.5 Low Pressure Core Spray (E21)

System Description

The low pressure core spray (LPCS) system consists of one independent pump and the valves and piping to deliver cooling water to a spray sparger over the core. The system is actuated by conditions indicating that a breach exists in the reactor coolant pressure boundary. However, water is delivered to the core only after reactor vessel pressure is reduced.

The LPCS injection piping enters the vessel, divides and enters the core shroud at two points near the top of the shroud. A semicircular sparger is attached to each outlet. Nozzles are spaced around the sparger to spray the water radially over the core and into the fuel assemblies.

The pump discharge line is maintained full by a jockey pump that takes suction from the LPCS pump suction line from the suppression pool and discharges downstream of the check valves on the LPCS pump discharge line. This pump is also used to supply water to the feedwater leakage control system (FWLCS) (N27).

System Boundary

System components subject to aging management review includes pumps, valves and piping components to convey water from the suppression pool to ASME Class 1 piping (which connects to a sparger), as shown on LR boundary drawings. The system also includes a pump to keep the LPCS pump discharge piping full. The LPCS pump seal water cyclone separator and associated piping are not shown on LR boundary drawings but are within scope.

ASME Class 1 components within this functional boundary are evaluated with the reactor coolant pressure boundary system. The core spray piping and sparger within the reactor vessel are evaluated with the reactor vessel internals system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP and EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

Provide core cooling by spraying coolant into the top of the fuel assemblies to mitigate accidents. This system along with the other ECCS systems satisfy the requirements of 10 CFR 50.46. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Provide low pressure reactor coolant make up after the vessel has been depressurized. [10 CFR 54.4(a)(3) – FP]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Component Types Subject to Aging Management Review

Table 2.3.2-5 lists the component types that require aging management review and their intended functions.

Table 3.2.2-5, Engineered Safety Features Systems – Low Pressure Core Spray System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-5
Low Pressure Core Spray
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Cyclone separator	Filtration, Pressure boundary
Flexible hose	Pressure boundary
Orifice	Flow restriction, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Pressure boundary

Component Type	Intended function
Valve body	Pressure boundary

References

UFSAR: 1.2.2.4.8.c, Table 6.1-1, 6.3.1.1.1, 6.3.2.2.3, 6.3.2.2.5, 6.9.2

License Renewal Drawings: 302-0574, 302-0705

2.3.2.6 Offgas (N64)

System Description

The main condenser offgas treatment system reduces the gaseous radwaste emission from the station. The offgas system uses a catalytic recombiner to recombine radiolytically dissociated hydrogen and oxygen. After cooling (to approximately 130°F) to strip the condensable gases and reduce the volume; the remaining incondensable gases (principally air with traces of krypton and xenon) will be delayed in the nominal 10-minute holdup system. The gas is cooled to 45°F and filtered through a HEPA filter. The gas is then passed through a desiccant dryer that reduces the dew point between 0°F and -40°F and is then chilled between 0°F and +40°F. Charcoal adsorption beds, normally operating in a refrigerated vault between 40°F and 0°F, selectively adsorb and delay the xenon and krypton gases from the bulk carrier gas (principally dry air). After the delay, the gas is again passed through a HEPA filter and discharged to the environment through the offgas building vent.

The offgas system is designed to limit the dose to offsite persons from routine station releases to significantly less than the limits specified in 10 CFR 20 and to operate within the emission rate limits established in the Offsite Dose Calculation Manual. The system does not contain any safety-related mechanical components.

The offgas charcoal vault refrigeration system consists of four 50 percent capacity air handling units, three 50 percent series connected brine cooling packages, two 100 percent capacity brine recirculation pumps, brine expansion tanks, brine filter drier, air distribution ductwork, and brine distribution piping. The offgas vault is divided into two pairs of rooms. Each pair is served by two air handling units, each capable of handling the total load per pair of rooms. During normal operation one air handling unit per room is operating and the other is a backup unit. It supplies recirculated cooled air to the vault to dissipate the heat load and maintain the vault in its operating band (normal range of 0°F to +40°F).

Two separate radiological analyses are provided for the control rod drop accident (CRDA):

1. The first analysis assumes the accident occurs at a low reactor power level with the mechanical vacuum pumps in operation or at any power level with a coincident loss of offsite power (LOOP);

2. The second analysis assumes the accident occurs at a higher reactor power level with the Steam Jet Air Ejectors in operation such that the condenser gases are processed through the offgas filtration system.

For the first CRDA scenario:

A coincident LOOP condition results in the automatic closure of the MSIVs, thereby stopping the transport of the fission products to the condenser. Radioactive release to the environment follows due to the condenser leakage. Alternatively, if the mechanical vacuum pumps are in operation (i.e., low reactor power level) at the time of the CRDA and a LOOP does not occur, the high radiation condition will be detected by the main steam line radiation monitors causing an automatic isolation of the operating mechanical vacuum pump line. Once again, the radioactive release to the environment will occur as a function of condenser leakage.

For the second CRDA scenario:

The transport pathway consists of carryover with steam to the turbine condenser and leakage from the condenser to the environment via the offgas (N64) system. Of the activity reaching the condenser, 100 percent of the noble gases, 10 percent of the iodine, and 1 percent of the particulate radionuclides remain airborne. The activity airborne in the condenser is processed by the offgas filtration system prior to release to the environment. Only the noble gases are released from the offgas system.

System Boundary

That portion of the offgas system upstream of the gas dryer prefilters is housed in the turbine building, which is a non-seismic, nonsafety class, reinforced concrete structure below grade. The remaining portion of this system is in the offgas building, which is a Safety Class 3, Seismic Category I, reinforced concrete structure. As the only license renewal intended function of the offgas system components is to maintain a leakage boundary per 10 CFR 54.4(a)(2), the system components subject to aging management are piping and valves that provide a fluid leakage boundary in the offgas building.

The system includes a “brine” cooling subsystem which contains a liquid fluorocarbon refrigerant. The brine remains liquid at room temperature and pressure, so the brine cooling system is within scope with a leakage boundary function. The brine is cooled by a refrigerant system which uses a fluorocarbon working fluid that is gaseous at room temperature and pressure. The system that cools the brine therefore corresponds to a gas in NEI 95-10 [Reference 1.3-3] and does not have a leakage boundary intended function.

Components containing turbine building closed cooling water are evaluated with the turbine building closed cooling (P44) system.

As documented in the NRC Safety Evaluation for PNPP License Amendment 166, the second CRDA scenario that credits the N62 and N64 systems is not used as a basis for acceptance for PNPP CRDA radiological consequences. Ultimately, the N64 system has no effect on the radiological consequences of a control rod drop accident, and as such does not meet 54.4(a) scoping criteria for mitigation of a CRDA.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Offgas system processes and controls the release of gaseous effluents from the main and auxiliary condensers to the environment.

Component Types Subject to Aging Management Review

Table 2.3.2-6 lists the component types that require aging management review and their intended functions.

Table 3.2.2-6, Engineered Safety Features Systems – Offgas System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-6
Offgas
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Filter housing	Leakage boundary
Heat exchanger (Channel)	Leakage boundary
Heat exchanger (Shell)	Leakage boundary
Moisture separator	Leakage boundary
Oil receiver	Leakage boundary
Oil separator	Leakage boundary
Orifice	Leakage boundary
Piping	Leakage boundary
Pump casing	Leakage boundary
Sight glass	Leakage boundary
Sight glass (Body)	Leakage boundary

Component Type	Intended function
Strainer body	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary
Ventilation cooler (Header)	Leakage boundary
Ventilation cooler (Tube)	Leakage boundary

References

UFSAR: 9.4.11.2, 11.3.1.1, 11.3.1.2, 11.3.2.1.1, 11.3.2.2.1.2.2, Table 9.4-27, 15.4.9.5

License Renewal Drawings: 302-0751, 302-0752, 302-0753, 302-0754, 913-0009, 913-0010, 913-0011, 913-0012

2.3.2.7 Reactor Core Isolation Cooling (E51)

System Description

The reactor core isolation cooling (RCIC) system provides makeup water to the reactor vessel when the vessel is isolated. The RCIC system uses a steam-driven turbine-pump unit and operates automatically in time and with sufficient coolant flow to maintain adequate water level in the reactor vessel, for the following conditions:

a. Reactor vessel isolated and maintained in the hot standby condition.

b. Reactor vessel isolated and accompanied by loss of coolant flow from the reactor feedwater system.

c. Initiation of plant shutdown with a loss of normal feedwater system before the reactor is depressurized to a level where the shutdown coolant system can be placed into operation.

The RCIC pump can supply demineralized makeup water from the condensate storage tank to the reactor vessel, with an alternate supply from the suppression pool.

A water leg pump maintains the RCIC lines full of water up to the injection valve.

At PNPP, the reactor core isolation cooling (RCIC) system is not considered an emergency core cooling system (ECCS).

System Boundary

System components subject to aging management review include pumps, valves, piping components, and a steam turbine associated with the RCIC supply, as shown on LR boundary drawings. The system includes a water leg pump to keep the pump piping filled. The system also includes a pump to supply hydraulic pressure to support testing of selected check valves.

ASME Class 1 components in the steam supply and in the pump discharge flow path are evaluated with the reactor coolant pressure boundary system. The reactor vessel head spray nozzle (pump discharge flow path) is evaluated with the Reactor Internals.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP, EQ, ATWS and SBO.

Reactor Core Isolation Cooling ensures adequate core cooling by providing high pressure injection to the reactor vessel. [10 CFR 54.4(a)(1), (a)(3) – ATWS, FP]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1), (a)(3) - SBO]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Component Types Subject to Aging Management Review

Table 2.3.2-7 lists the component types that require aging management review and their intended functions.

Table 3.2.2-7, Engineered Safety Features Systems – Reactor Core Isolation Cooling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-7
Reactor Core Isolation Cooling
Component Types Subject to Aging Management Review

Component Type	Intended function
Accumulator	Leakage boundary
Bolting	Leakage boundary, Pressure boundary
Cooler (Channel)	Pressure boundary

Cooler (Shell)	Pressure boundary
Cooler (Tubes)	Heat transfer, Pressure boundary
Cooler (Tubesheet)	Pressure boundary
Cyclone separator	Filtration, Pressure boundary
Drain pot	Pressure boundary
Filter housing	Pressure boundary
Flexible hose	Leakage boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary, Pressure boundary
Rupture disc	Pressure boundary
Sight glass	Pressure boundary
Sight glass (Body)	Pressure boundary
Sparger (Turbine exhaust)	Direct flow
Strainer body	Leakage boundary
Turbine casing	Pressure boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 1.2.2.4.7, 5.4.6.1, Appendix 15C, Appendix 15H.2

License Renewal Drawings: 302-0574, 302-0631, 302-0632

2.3.2.8 Residual Heat Removal (E12) and Containment Spray (E15)

System Description

The residual heat removal (RHR) system removes decay and sensible heat during and after plant shutdown, injects water into the reactor vessel following a loss-of-coolant accident to reflood the core and maintain fuel cladding below peak cladding temperature consistent with 10 CFR 50.46 requirements. The RHR system removes heat from the containment following a loss-of-coolant accident to limit the increase in containment pressure. This is accomplished by cooling and recirculating the suppression pool water and by spraying the containment air space with suppression pool water. Containment spray uses two redundant subsystems, each with its own full capacity spray header. Each subsystem is supplied from a separate redundant RHR subsystem.

The RHR system is comprised of three independent loops. Each loop contains its own motor-driven pump, piping, valves, instrumentation and controls. Each loop has a suction source from the suppression pool and is capable of discharging water to the reactor vessel via a separate nozzle, or back to the suppression pool via a full flow test line. In addition, the A and B loops have heat exchangers which are cooled by emergency service water. Loops A and B can also take suction from the reactor recirculation system suction or fuel pool, and can discharge into the reactor via the feedwater line, fuel pool cooling discharge, or to the containment spray spargers.

The Division 1 pump discharge line is kept full by a jockey pump that takes a suction from the low pressure core spray pump suction line from the suppression pool and discharges downstream of the check valve on the RHR A pump discharge line. The Division 2 pumps' discharge lines are kept full by a jockey pump that takes suction from the C RHR pump suction line from the suppression pool and discharges downstream of the check valves on the B and C RHR pump discharge lines. These pumps are also used to supply water to the feedwater leakage control system (FWLCS) (N27).

The system has four primary modes of operation:

1. Residual Heat Removal Mode (Shutdown Cooling Mode) to remove decay and sensible heat from the reactor primary system.
2. Low Pressure Coolant Injection (LPCI) Mode to pump water from the suppression pool into the core region of the vessel using separate pump loops for a design-basis LOCA.
3. Suppression Pool Cooling Mode to cool and mix the suppression pool.
4. Containment Spray Cooling Mode to spray into the containment and suppression pool vapor space, reducing internal pressure to below design limits.

The Reactor Steam Condensing Mode of RHR operation is not used at PNPP.

System Boundary

System components subject to aging management review include three residual heat removal pumps, a water leg pump, four heat exchangers, valves, and piping components, including the containment spray rings and nozzles as shown on LR boundary drawings. The RHR pump seal water cyclone separators and associated piping are not shown on LR boundary drawings but are within scope.

ASME Class 1 piping components are evaluated with the reactor coolant pressure boundary. The RHR low pressure coolant injection (LPCI) lines inside the RPV and the LPCI flow deflector are evaluated with the reactor internals (B13b).

Thermowells PY-1E12W0003A & 3B and PY-1E12W0005A & 5B are evaluated with system P45, as they are in the emergency service water (ESW) piping. Valve PY-1E12F0565 is evaluated with liquid radwaste disposal system (G50), as it is within the piping for that system.

Combustible gas mixing system (M51) lube oil and after cooler valves that are supplied water from RHR are evaluated in this residual heat removal (E12) system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP, EQ and ATWS.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

Low-pressure coolant injection provides flow to the reactor vessel to mitigate accidents. This system along with the other ECCS systems satisfy the requirements of 10 CFR 50.46. [10 CFR 54.4(a)(1), (a)(3) - FP]

Provide a flow path for alternate injection sources to the reactor vessel. [10 CFR 54.4(a)(1)]

Remove heat from reactor and/or provide bulk mixing of the suppression pool to remove heat during normal and accident conditions. [10 CFR 54.4(a)(1), (a)(3) – FP, ATWS]

Containment spray removes heat from containment and serves as a containment atmosphere fission product removal mechanism. [10 CFR 54.4(a)(1)]

Remove heat from the upper fuel pool, and the spent fuel pool. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains safety-related indication. [10 CFR 54.4(a)(1), (a)(3) - EQ]

Component Types Subject to Aging Management Review

Table 2.3.2-8 lists the component types that require aging management review and their intended functions.

Table 3.2.2-8, Engineered Safety Features Systems – Residual Heat Removal and Containment Spray Systems – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-8
Residual Heat Removal (E12) and Containment Spray
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Cyclone separator	Filtration, Pressure boundary
Flexible hose	Leakage boundary
Heat exchanger (Channel)	Pressure boundary
Heat exchanger (Shell)	Pressure boundary
Heat exchanger (Tube)	Heat transfer, Pressure boundary
Heat exchanger (Tubesheet)	Pressure boundary
Orifice	Flow restriction, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Pressure boundary
Spray nozzle	Spray
Valve body	Pressure boundary, Leakage boundary

References

UFSAR: 1.2.2.3.4, 1.2.2.4.8.d, 1.2.2.4.9.4, 1.2.2.4.14, 5.4.7, Table 6.1-1, 6.2.2.2, 6.3.1.1.1, 6.3.1.2.3, 6.3.2.2.4, 6.3.2.2.5, 6.5.2, Appendix 15C.3

License Renewal Drawings: 302-0574, 302-0641, 302-0642, 302-0643, 302-0661, 302-0831

2.3.2.9 Suppression Pool (T21)

System Description

A suppression pool, located within containment, contains a large amount of water used to rapidly condense steam from reactor vessel blowdown or from a break in a major pipe. When needed to protect against overpressure, or to depressurize the reactor, safety/relief valves on the main steam lines (System B21 nuclear boiler) discharge steam through a discharge line to a point below the minimum water level in the suppression pool.

The suppression pool suction strainer provides filtered (strained) water from the suppression pool to the high pressure core spray pump, the low pressure core spray pump, the reactor core isolation cooling pump, and to the A, B, and C residual heat removal pumps. The suction strainer is designed to preclude the potential for loss of

NPSH caused by debris blockage during the period that the ECCS is required to maintain long-term cooling. The large toroidal passive strainer results in a very low approach velocity for water entering the strainer. The refueling bellows, which separates the drywell from the upper pool, is also evaluated within this system.

System Boundary

Mechanical components subject to aging management review are the suppression pool strainer, as shown on LR boundary drawings, and the refueling bellows, which separates the drywell from the upper pool.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP, ATWS and SBO.

Provides strained water for RHR pump operation, LPCS pump operation, HPCS pump operation and RCIC pump operation. [10 CFR 54.4(a)(1), (a)(3) – FP, ATWS, SBO]

The containment suppression pool provides steam suppression for transient discharges coming from the SRVs and the drywell vents; and provides a heat sink for pressure suppression during a LOCA. [10 CFR 54.4(a)(1), (a)(3) – FP, ATWS, and SBO]

The containment suppression pool provides a water seal between the containment vessel and drywell volume [10 CFR 54.4(a)(1)]

Provides a pressure barrier between the upper pool and the drywell (refueling bellows) during plant refueling operations. [10 CFR 54.4(a)(1)]

Component Types Subject to Aging Management Review

Table 2.3.2-9 lists the component types that require aging management review and their intended functions.

Table 3.2.2-9, Engineered Safety Features Systems – Suppression Pool System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.2-9
Suppression Pool
Component Types Subject to Aging Management Review

Component Type	Intended function
Bellows (Rx vessel to pool)	Pressure boundary
Bolting	Structural integrity
Strainer	Filtration

References

UFSAR: 1.2.2.4.9.1, 5.2.2.4.1, 6.3.2.2, Appendix 9A.3, Appendix 15C.3; Appendix 15H.2.2

License Renewal Drawings: 302-0574, 302-0651

2.3.3 AUXILIARY SYSTEMS

The following systems are included in this section:

- Auxiliary Building Ventilation (Section 2.3.3.1)
- Breathable Air (Section 2.3.3.2)
- Building Heating (Section 2.3.3.3)
- Combustible Gas Control (Section 2.3.3.4)
- Computer Room HVAC (Section 2.3.3.5)
- Containment and Drywell Vacuum Relief (Section 2.3.3.6)
- Containment Integrated Leak Rate Test (Section 2.3.3.7)
- Containment Vessel and Drywell Purge (Section 2.3.3.8)
- Containment Vessel Chilled Water (Section 2.3.3.9)
- Control and Computer Room Humidification (Section 2.3.3.10)
- Control Complex Chilled Water (Section 2.3.3.11)
- Control Rod Drive (Section 2.3.3.12)
- Control Room HVAC and Emergency Recirculation (Section 2.3.3.13)
- Controlled Access and Miscellaneous Equipment Areas HVAC (Section 2.3.3.14)
- Diesel Generator and Auxiliaries (Section 2.3.3.15)
- Diesel Generator Building Ventilation (Section 2.3.3.16)
- ECCS Pump Room Cooling (Section 2.3.3.17)
- Emergency Closed Cooling (Section 2.3.3.18)
- Emergency Closed Cooling Pump Area HVAC (Section 2.3.3.19)
- Emergency Service Water (Section 2.3.3.20)
- Emergency Service Water Pump House Ventilation (Section 2.3.3.21)
- Emergency Service Water Screen Wash (Section 2.3.3.22)
- Feedwater Zinc Injection (Section 2.3.3.23)
- Fire Protection (Section 2.3.3.24)
- Floor and Equipment Drains (Section 2.3.3.25)
- Fuel Handling Area Ventilation (Section 2.3.3.26)
- Fuel Storage and Fuel Pool Cooling and Cleanup (Section 2.3.3.27)
- Hydrogen Water Chemistry (Section 2.3.3.28)
- Inclined Fuel Transfer System (Section 2.3.3.29)

- Industrial Waste Disposal (Section 2.3.3.30)
- Intermediate Building Ventilation (Section 2.3.3.31)
- Leak Detection (Section 2.3.3.32)
- Liquid Radwaste Disposal (Section 2.3.3.33)
- Liquid Radwaste Sumps (Section 2.3.3.34)
- MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust (Section 2.3.3.35)
- Miscellaneous Area Ventilation (Section 2.3.3.36)
- Miscellaneous Electrical Areas Smoke Ventilation (Section 2.3.3.37)
- Miscellaneous Sump (Section 2.3.3.38)
- Nitrogen Supply (Section 2.3.3.39)
- Nuclear Closed Cooling (Section 2.3.3.40)
- Offgas Building Ventilation (Section 2.3.3.41)
- Penetration Electrical (Section 2.3.3.42)
- Penetration Pressurization (Section 2.3.3.43)
- Plant Foundation Underdrain (Section 2.3.3.44)
- Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring (Section 2.3.3.45)
- Post-Accident Sampling (Section 2.3.3.46)
- Potable Water Supply (Section 2.3.3.47)
- Rx Plant Sampling (Section 2.3.3.48)
- Radwaste Building Ventilation (Section 2.3.3.49)
- Reactor Vessel Servicing Equipment (Section 2.3.3.50)
- Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer (Section 2.3.3.51)
- Safety Related Instrument Air (Section 2.3.3.52)
- Sanitary Drain and Sewer (Section 2.3.3.53)
- Service Air and Instrument Air (Section 2.3.3.54)
- Service Water (Section 2.3.3.55)
- Standby Liquid Control (Section 2.3.3.56)
- Steam Tunnel Cooling (Section 2.3.3.57)
- Storm Drain and Sewer (Section 2.3.3.58)
- Suppression Pool Drain and Clean Up (Section 2.3.3.59)

- Suppression Pool Makeup (Section 2.3.3.60)
- Turbine Building Chilled Water (Section 2.3.3.61)
- Turbine Building Closed Cooling (Section 2.3.3.62)
- Turbine Building Ventilation (Section 2.3.3.63)

2.3.3.1 Auxiliary Building Ventilation (M38)

System Description

The auxiliary building ventilation system (ABVS) operates continuously to provide filtered and tempered outside air to various areas of the auxiliary building. The ABVS operates continuously to exhaust various areas of the auxiliary building and to direct this exhaust through a charcoal filter plenum to the unit vent. The supply system consists of one 100 percent capacity supply plenum housing roughing filters and hot water heating coils, two 100 percent capacity supply fans and supply distribution ducts. The exhaust system consists of one 100 percent capacity filter plenum which houses roughing, HEPA, charcoal and a second bank of HEPA filters, two 100 percent capacity exhaust fans, and exhaust distribution ducts. The supply and exhaust ductwork is arranged to serve the following areas:

a. Turbine building chiller hallway area;

b. LPCS pump room;

c. RHR "B" pump and heat exchanger room;

d. RHR "C" pump room;

e. RCIC pump room;

f. RHR "A" pump room and heat exchanger room;

g. HPCS pump room;

h. RWCU pump room;

i. Steam tunnel area;

j. Auxiliary building hallway; and

k. Alternate Decay Heat Removal (ADHR) System heat exchanger room.

During periods of emergency, the ABVS is not required to operate to safely shut down the plant.

The ABVS is classified as nonsafety-related and non-seismic category, except for the exhaust system charcoal filter plenum and for ductwork in close proximity to safety class equipment.

For the ADHR system, two packaged ABVS air conditioning units ensure that the temperature and relative humidity in the areas surrounding the ADHR pump and heat exchanger are not adversely impacted during the operation of the ADHR system.

System Boundary

System components subject to aging management review include fire dampers and associated duct, and condenser, plenum, valves, and piping components that provide leakage boundaries, as shown on the LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

System fire dampers prevent the spread of fires. [10 CFR 54.4(a)(3) – FP]

Provide filtered and tempered outside air to various areas of the auxiliary building.

Filter auxiliary building exhaust air to keep radioactivity release to the environment below permissible discharge limits.

Component Types Subject to Aging Management Review

Table 2.3.3-1 lists the component types that require aging management review and their intended functions.

Table 3.3.2-1, Auxiliary Systems – Auxiliary Building Ventilation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-1
Auxiliary Building Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Condenser endbell	Leakage boundary
Damper housing	Pressure boundary

Component Type	Intended function
Duct	Pressure boundary
Filter plenum	Leakage boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.4.3.1.1, 9.4.3.2.1, 9.4.12.2.10, Appendix 9A.4.2

License Renewal Drawings: 912-0613, 912-0615

2.3.3.2 Breathable Air (P58)

System Description

Breathing protection apparatus are provided for control room occupants. Breathable air is provided by 10 compressed air cylinders located in the service building at elevation 620'-6". This air system supplies six breathable air stations with five connections on each station located in the control room. Self-contained breathing apparatus (SCBA) are provided for control room occupants. These SCBA can be supplied with air from the six breathable air stations in the control room or their own one hour compressed air bottle. The capacity of the 10 compressed air cylinders is sufficient to supply seven people for approximately six hours, plus each person has a one-hour supply in their SCBA bottle. The SCBA bottles and the large air cylinders can be filled by a breathable air compressor located onsite or via offsite services.

In the event of smoke or toxic gas in-leakage to the control room, the system provides a source of breathing air for use by operators.

System Boundary

System components subject to aging management review include filter housings, valves, tanks and piping components that supply breathing air to the control room personnel.

SCBA masks and (portable) air cylinders are consumables that do not require an aging management review.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent satisfactory accomplishment of functions credited for mitigation of a design basis event and contains components that are relied on to perform a function that demonstrates compliance with the regulations for FP.

In the event of smoke or toxic gas in-leakage to the Control Room, the system provides a source of breathing air for use by operators. [10 CFR 54.4(a)(2), (a)(3) – FP]

Component Types Subject to Aging Management Review

Table 2.3.3-2 lists the component types that require aging management review and their intended functions.

Table 3.3.2-2, Auxiliary Systems – Breathable Air System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-2
Breathable Air
Component Types Subject to Aging Management Review

Component Type	Intended function
Filter housing	Pressure boundary
Flexible hose	Pressure boundary
Piping	Pressure boundary
Tank	Pressure boundary
Valve body	Pressure boundary

References

UFSAR: 2.2.3.1.2.2, 2.2.3.1.3.1, 6.4.1.h

License Renewal Drawings: 302-0261

2.3.3.3 Building Heating (P55)

System Description

The heating system consists of two 100 percent shell and tube type heat exchangers (steam-water), two 100 percent circulation pumps, an expansion tank, a chemical mixing tank, hot water and electric unit heaters located at various buildings and elevations, valves, and distribution piping. The two steam sources for the hot water heating system are the extraction steam system (normal) and the auxiliary steam system (shutdown and startup). Two 100 percent heat exchangers are provided so that one heat exchanger will only use steam from the extraction steam system and the other heat exchanger will only use steam from the auxiliary steam system. This design precludes direct contamination of the auxiliary steam system by the extraction steam system.

During normal plant winter operation, the extraction steam heat exchanger and one of the two circulation pumps are in operation. Extraction steam is supplied to the shell of the heat exchanger to heat the water in the tube to 190°F. The steam heated water is then supplied to the hot water heating coils and hot water unit heaters located at various buildings and elevations. Hot water is also supplied to the mixed bed demineralizer system, two bed demineralizer system and condensate transfer and storage system heat exchangers for freeze protection. Hot water heating coils are used in conjunction with the building ventilation systems. They add heat to the supply air prior to distribution if the air temperature drops below the air temperature controller preset value. Hot water heating coils are used in the supply plenum of the following ventilation systems:

a. Auxiliary building ventilation system

b. Fuel handling building ventilation system

c. Heater bay ventilation system

d. Intermediate building ventilation system

e. Containment vessel purge supply system

f. Radwaste building ventilation system

g. Turbine power complex ventilation system

h. Turbine building ventilation system

Hot water and electric unit heaters are used to provide heat to the space they serve. When the space temperature drops below the preset value, the space thermostat provided with each heater will automatically operate the unit heater and will automatically stop the unit heater when the space temperature satisfies the thermostat set point. The following buildings are provided with hot water unit heaters:

a. Auxiliary Building
b. Auxiliary Boiler Building
c. Heater bay
d. Intermediate Building
e. Offgas Building
f. Radwaste Building
g. Turbine Building
h. Turbine Power Complex
i. Water Treating Building

The following buildings are provided with electric unit heaters:

a. Fuel Oil Pumphouse

b. Circulating Water Pumphouse
c. Diesel Generator Building
d. Discharge Tunnel Dechlorination Equipment Building
e. Decant Control Structure
f. Emergency Service Water Pumphouse
g. Reactor Building Annulus
h. Service Water Pumphouse
i. Control Complex stairway at Elevation 707’-2”

If heating is required during plant startup and shutdown, the aux steam heat exchanger and one of the two circulation pumps will operate. Operation is the same as described above except that steam is supplied to the heat exchanger by the auxiliary steam system. An expansion tank is also provided to allow water to expand as the water temperature rises. This tank is also pressurized with compressed nitrogen to help maintain the water pressure above the extraction steam pressure (60 psig minimum water pressure vs. 50 psig extraction steam pressure). This will prevent contamination of the hot water distribution system by the extraction steam. Pressure in the expansion tank is maintained at 70 psig by the addition of compressed nitrogen utilizing a nitrogen generator or N2 bottled gas. A pressure relief valve on the expansion tank relieves excessive tank pressure. Two-bed demineralized water (80-120 psig) is supplied for makeup water and water required to initially fill the system. This water is supplied through a valve controlled from level switches on the expansion tank. The valve closes when the water level in the expansion tank returns to high level. The valve is controlled between high and low level.

The system also provides Condensate Storage Tank freeze protection.

System Boundary

System components subject to aging management review include nonsafety-related area heaters, ventilation heaters, and piping system components that are located within structures that contain safety-related components, as shown on the LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Provide area and ventilation heating to maintain indoor area temperatures.

Provide Condensate Storage Tank freeze protection.

Component Types Subject to Aging Management Review

Table 2.3.3-3 lists the component types that require aging management review and their intended functions.

Table 3.3.2-3, Auxiliary Systems – Building Heating System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-3
Building Heating
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Heat exchanger (Area heater - Header)	Leakage boundary
Heat exchanger (Area heater - Tube)	Leakage boundary
Heat exchanger (Ventilation heater - Header)	Leakage boundary
Heat exchanger (Ventilation heater - Tube)	Leakage boundary
Orifice	Leakage boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.4.10

License Renewal Drawings: 913-0016, 913-0017

2.3.3.4 Combustible Gas Control (M51)

System Description

The Containment Combustible Gas Control System (CCGCS) consists of four subsystems:

1. Hydrogen Analysis System
2. Hydrogen Mixing System
3. Hydrogen Recombination System
4. Combustible Gas Purge System

The hydrogen analysis system consists of two completely redundant hydrogen analyzers each with control room recorders and switch stations. One is supplied by Division 1, the other by Division 2. Each analyzer samples from four redundant sample lines: one from above the suppression pool, one from the space between the reactor vessel head and the drywell dome, one from the top of the drywell area, and one from the top of the dome of the containment vessel. Each sample point is manually selected for continuous sampling. After passing through the analyzers, the gas samples and any associated moisture are returned to the containment in an area above the suppression pool. Each analyzer has the capability to measure a range of 0-10% hydrogen concentration and is provided with reference and calibration gases as required. Each analyzer has alarms to annunciate in the control room for the following conditions; high and high-high hydrogen concentration, low sample flow, and system failure. The sample isolation valves are closed during normal plant operation. They are opened by an administratively controlled key operated switch prior to starting the hydrogen analyzers following a LOCA.

The hydrogen mixing system consists of two completely independent redundant systems located in adjacent quadrants of the containment building. Each system consists of one air compressor and related ductwork. Initial control of the hydrogen concentration following a LOCA will be accomplished by mixing volumes of potentially high and low hydrogen concentrations. Mixing is accomplished by means of redundant, 500 scfm, centrifugal air compressors which take suction from the containment volume just below the service floor and at the containment dome and discharge into the drywell. This pressurizes the drywell sufficiently to provide increase in drywell bypass leakage and uncover the upper row of suppression pool vents. The system is normally idle except for periodic testing. Following a LOCA, each mixing system is started manually on high hydrogen concentration in the drywell.

The hydrogen recombination system consists of two completely redundant systems located in the containment. Each system consists of a recombiner unit, a power supply cabinet and control panel which are separately mounted. The power supply cabinet and control panel are located outside containment. A wattmeter and thermocouple readout are provided on the control panel to monitor performance. The hydrogen recombiners are remote-manually initiated from the control complex. Except for periodic testing, the recombiners are idle during normal operation.

The combustible gas purge system is designed to aid in the cleanup of hydrogen. This purge system is manually operated from the control room. The system is designed to utilize the annulus gas treatment unit (AEGTS) to exhaust the hydrogen laden air from the drywell/containment. The system is provided with two containment isolation valves and a flow control valve failed in the open position which allows straight through flow to the AEGTS filters. The AEGTS is normally in service. The combustible gas purge system is normally used for drywell pressure control during plant startup and operation.

System Boundary

System components subject to aging management review include the recombiner housings, and various piping components associated with hydrogen analyzers, mixing compressor units, and the purge flow path as shown on the LR boundary drawings.

Piping and valves associated with the supply of emergency closed cooling water to the sample coolers are evaluated with the emergency closed cooling system (P42).

Piping and valves associated with the supply of RHR (cooling water) to the mixing compressors are evaluated with residual heat removal system (E12).

Piping associated with sample flow path to the PASS system is evaluated in post-accident sampling system (P87).

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Control hydrogen concentration in containment following a loss of coolant accident. [10 CFR 54.4(a)(1)]

Provide indication of containment hydrogen concentration. [10 CFR 54.4(a)(1)]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Component Types Subject to Aging Management Review

Table 2.3.3-4 lists the component types that require aging management review and their intended functions.

Table 3.3.2-4, Auxiliary Systems – Combustible Gas Control System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-4
Combustible Gas Control
Component Types Subject to Aging Management Review

Component Type	Intended function
Analyzer body	Pressure boundary
Bolting	Leakage boundary, Pressure boundary, Structural integrity
Compressor housing	Pressure boundary
Filter housing	Pressure boundary
Flexible hose	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (Channel)	Pressure boundary
Heat exchanger (Shell)	Pressure boundary
Heat exchanger (Tube)	Heat transfer, Pressure boundary
Heat exchanger (Tubesheet)	Pressure boundary
Moisture separator	Pressure boundary
Orifice	Flow restriction, Pressure boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
Pump casing	Leakage boundary, Pressure boundary
Recombiner housing	Pressure boundary
Screen	Filtration
Sight glass	Pressure boundary
Sight glass (Body)	Pressure boundary
Tank (oil reservoir)	Pressure boundary
Valve body	Pressure boundary

References

UFSAR: 1.2.2.4.9.5, 6.2.5.2.2, 7.3.1.1.11

License Renewal Drawings: 302-0831, 302-0832

2.3.3.5 Computer Room HVAC (M27)

System Description

The computer room HVAC system operates continuously during normal plant operation to provide cooling and to maintain humidification in the computer room, to cool adjacent cable spreading areas and to supplement cooling of the control complex HVAC equipment room. The HVAC system consists of two 100 percent capacity supply air handling units, each including roughing filters, chilled water cooling coils and supply duct systems with steam humidifiers.

The duct systems are arranged so that cooled air from the air handling unit is ducted directly to the computer room. After absorbing heat from the computer room equipment, this air passes through the adjacent cable spreading area and returns to the heating and ventilating equipment room where the cooling cycle is repeated. During normal plant operation, power will be provided to this system from the preferred ac source. During periods of emergency, this system is not required to operate to safely shut down the plant.

This system is classified as nonsafety-related and non-seismic category. However, the cooling coils and related piping of this system will not rupture during a safe shutdown earthquake or an operating basis earthquake.

System Boundary

System components subject to aging management review are limited to fire dampers, as depicted on the LR boundary diagram.

Cooling water piping and cooler components associated with the air handling units are evaluated with the Control Complex Chilled Water system. Humidification components are evaluated with the Control and Computer Room Humidification system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

System fire dampers prevent the spread of fire. [10 CFR 54.4(a)(3) – FP]

Maintain computer room and cable spreading area temperature and humidity within normal limits.

Component Types Subject to Aging Management Review

Table 2.3.3-5 lists the component types that require aging management review and their intended functions.

Table 3.3.2-5, Auxiliary Systems – Computer Room HVAC System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-5
Computer Room HVAC
Component Types Subject to Aging Management Review

Component Type	Intended function
Damper housing	Pressure boundary

References

UFSAR: 9.4.1.1.4, 9.4.1.2.4

License Renewal Drawings: 912-0607

2.3.3.6 Containment (M17) and Drywell (M16) Vacuum Relief

System Description

The containment vacuum relief system limits the buildup of negative pressure inside the containment vessel if one or both of the containment spray loops are inadvertently actuated. The check valves are normally closed while the motor operated isolation valves are normally open. The motor-operated isolation valve is closed automatically by a containment isolation signal. If vacuum relief is required during containment isolation, differential pressure devices provide an isolation override and automatically open the valve as required.

The drywell vacuum relief system equalizes pressure between the drywell and outer containment volume (portion of containment volume outside drywell). The only safety function of the system is to provide drywell to containment isolation. Both the check valves and the motor-operated isolation valves are normally closed when the differential pressure between the containment and drywell is zero or positive. When the differential pressure between the containment and drywell is negative, the motor-operated isolation valves are opened electrically. The check valves open in response to the differential pressure and thus provide vacuum relief. The motor-operated isolation valves also close automatically on a containment isolation signal which consists of reactor low-low level or drywell high pressure. The containment isolation signal is overridden, and the motor-operated isolation valves are automatically opened by a negative differential pressure signal.

System Boundary

System components subject to aging management review include safety-related valves and piping components that span the drywell and the containment and shield building walls, as depicted on the license renewal boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Maintain drywell integrity. [10 CFR 54.4(a)(1)]

Relieve the vacuum formed by inadvertent containment spray initiation. [10 CFR 54.4(a)(1)]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Limit negative drywell/containment differential pressure to prevent Drywell flooding.

Component Types Subject to Aging Management Review

Table 2.3.3-6 lists the component types that require aging management review and their intended functions.

Table 3.3.2-6, Auxiliary Systems – Containment and Drywell Vacuum Relief System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-6
Containment and Drywell Vacuum Relief
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Orifice	Flow restriction, Pressure boundary
Piping	Pressure boundary
Valve body	Pressure boundary

References

UFSAR: 7.3.1.1.13, 7.7.1.12, 6.2.7.1.i

License Renewal Drawings: 912-0606

2.3.3.7 Containment Integrated Leak Rate Test (E61)

System Description

The containment integrated leak rate test system enables pressurizing the containment and drywell to measure leakage rates from these areas. Instrument test lines and pressurization lines terminate in the annulus, containment and drywell to provide for this testing. The primary purpose of the system is to measure the overall leakage rate of the containment vessel and all penetrations and appurtenances. The secondary purpose is to measure the drywell leakage rate.

System Boundary

System components subject to aging management review include safety-related piping components that either support pressure testing of containment and the drywell or provide a pressure boundary function, and the attached nonsafety-related piping that provides structural support to the safety-related piping, as shown on the LR boundary drawing.

The nonsafety-related piping that only penetrates the shield building is not attached to safety-related piping and does not perform a license renewal intended function.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Containment and annulus isolation limits radiological release. [10 CFR 54.4(a)(1)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

Table 2.3.3-7 lists the component types that require aging management review and their intended functions.

Table 3.3.2-7, Auxiliary Systems – Containment Integrated Leak Rate Test – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-7
Containment Integrated Leak Rate Test
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Piping	Pressure boundary, Structural integrity
Piping (Spectacle flange)	Pressure boundary
Valve body	Pressure boundary, Structural integrity

References

UFSAR: 6.2.6, 6.2.3.1.d

License Renewal Drawings: 302-0811

2.3.3.8 Containment Vessel and Drywell Purge (M14)

System Description

The system reduces the activity level in the containment vessel and drywell to a safe level for entry of personnel, maintains a safe atmosphere during refueling operations and provides a means of controlled release of activity to the environment.

The containment vessel and drywell purge system is divided into the containment vessel purge supply subsystem, drywell purge supply subsystem, and the purge exhaust subsystem.

The containment vessel purge supply subsystem is located in the intermediate building and provides filtered and heated outside air to the containment vessel at a constant rate. The supply air is discharged into the containment vessel and circulated by the containment vessel fan cooler units.

During the drywell purge mode of system operation (used during refueling and cold shutdown only) the drywell purge supply subsystem directs air from the containment vessel ambient into the drywell area where it is circulated by the drywell fan cooler units.

The section of the drywell purge supply lines between the isolation valves can be filled with water to provide shielding. The water provides shielding to minimize radiation streaming in the area of the containment adjacent to the drywell purge supply lines.

The purge exhaust subsystem is located in the intermediate building. It draws air from the containment vessel and drywell and exhausts it through two trains of roughing filters, HEPA prefilters, charcoal filters, and HEPA after-filters. The exhaust air is then discharged to the atmosphere through the unit vent. Drywell purge exhaust and supply subsystem isolation valves are passive isolation valves which remain closed during Modes 1, 2 and 3.

Components of the containment vessel and drywell purge system, except for the purge isolation valves and the charcoal exhaust plenums, are nonsafety-related and non-seismic classified. The purge isolation valves and accessories are classified as Safety Class 2, Seismic Category I. The charcoal exhaust plenums are classified as nonsafety-related, Seismic Category I.

The active purge supply and exhaust containment isolation valves are fast acting valves (4 seconds) which close on a containment isolation signal (high drywell pressure and/or low reactor vessel water level). These valves also close on a high radiation signal in the exhaust line.

System Boundary

System components subject to aging management review include isolation valves and piping components associated with (M14) drywell and containment penetrations in containment and the intermediate building, as shown on the LR boundary drawing.

Fire protection and hot water piping are evaluated in fire protection and building heating systems (P54 and P55, respectively).

Demineralized water system components associated with the fill/drain lines for the drywell purge supply ducting are evaluated with mixed bed demineralizer and distribution system (P22).

Radiation monitoring devices associated with the containment and drywell purge system (M14) are evaluated in the plant radiation monitoring system (D17).

Unit 2 Containment Isolation Valves 2M14F0040, 2M14F0085, and 2M14F0200 are evaluated within structural as part of the building penetration and are not addressed here.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Component Types Subject to Aging Management Review

Table 2.3.3-8 lists the component types that require aging management review and their intended functions.

Table 3.3.2-8, Auxiliary Systems – Containment Vessel and Drywell Purge System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-8
Containment Vessel and Drywell Purge
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Filter housing	Leakage boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 9.4.6.2.3, 9A.4.1.1, 9.4.6.3.3, 9.4.6.5.3

License Renewal Drawings: 302-0881, 912-0604

2.3.3.9 Containment Vessel Chilled Water (P50)

System Description

The containment vessel chilled water system operates continuously during normal operation to provide chilled water to the chilled water coils of the various containment vessel cooling system air handling units and the inservice inspection room air handling units for the purpose of cooling the air supplied to the areas served by these air handling units. Three 100 percent capacity water chilling machines and three 100 percent capacity chilled water recirculating pumps are provided. Normally, one set of chiller and pump provides service with the second and third sets as backup. Condenser water is provided by the nuclear closed cooling system during operation. This system is not required to operate during LOCA or loss of offsite power. The pumps, chillers, valves, piping, and tanks are of standard industrial design and are classified as nonsafety-related and non-seismic. However, isolation valves in the containment vessel penetration line are Safety Class 2 and Seismic Category I.

The containment vessel chilled water system is not required to operate to safely shut down the plant following a design basis accident.

System Boundary

System components subject to aging management review include ventilation cooling coils and headers, pumps, tanks, valves, and various piping components as shown on the LR boundary drawings. Various chiller subcomponents not shown on the boundary drawings are also subject to aging management review.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Provide chilled water to the containment vessel air handling units.

Component Types Subject to Aging Management Review

Table 2.3.3-9 lists the component types that require aging management review and their intended functions.

Table 3.3.2-9, Auxiliary Systems – Containment Vessel Chilled Water System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-9
Containment Vessel Chilled Water
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Filter housing	Leakage boundary
Heat exchanger (Channel)	Leakage boundary
Heat exchanger (Shell)	Leakage boundary
Heat exchanger (Ventilation cooling coil)	Leakage boundary
Heat exchanger (Ventilation cooling header)	Leakage boundary
Orifice	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Sight glass	Leakage boundary
Sight glass (Body)	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 9.4.9.2.3, 9.4.9.3

License Renewal Drawings: 913-0007, 913-0008

2.3.3.10 Control and Computer Room Humidification (M29)

System Description

During normal operation, the electric steam boiler supplies the central type humidifiers with steam. The humidifiers are located in control room return duct downstream of the return fans and in the branch supply ducts of the computer room HVAC system. Humidity controllers located in the computer room and control room modulate the needle valve of the corresponding humidifier, thereby discharging the right quantity of steam to the air stream and satisfying humidity controller set point.

The boiler is an electric steam boiler generating steam by electric heating. The humidifiers are of the electric modulating control, steam separator type, providing full separation ahead of an integral steam jacketed control valve. The distribution manifold, located in the duct, provides uniform steam distribution (against air stream flow) over its entire length and is steam jacketed to ensure that the vapor discharged is free of water droplets.

The components of this system are of the standard industrial design and are classified as nonsafety and non-seismic.

The electric boiler can produce saturated steam at 5 to 10 psig. This boiler supplies a low pressure humidification system, with piping defined as high energy piping.

An analysis of possible effects of jets and pipe whip due to humidification system breaks shows that safe shutdown is not jeopardized. The low power rating of the boiler and the small energy reservoir of the system preclude any rapid environmental effects. Redundant leak detection sensors are provided to ensure that any failure is detected with ample time to shut off the boiler before environmental effects could compromise safe shutdown components.

System Boundary

System components subject to aging management review include the boiler, humidifiers, distribution manifolds, and piping and valves associated with the control room and computer room humidification system, as shown on the LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Maintain control room and computer room humidity within desired range.

Component Types Subject to Aging Management Review

Table 2.3.3-10 lists the component types that require aging management review and their intended functions.

Table 3.3.2-10, Auxiliary Systems – Control and Computer Room Humidification System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-10
Control and Computer Room Humidification
Component Types Subject to Aging Management Review

Component Type	Intended function
Boiler	Leakage boundary
Bolting	Leakage boundary
Distribution manifold	Leakage boundary
Humidifier	Leakage boundary
Piping	Leakage boundary
Rupture disc	Leakage boundary
Sight glass	Leakage boundary
Sight glass (Body)	Leakage boundary
Strainer body	Leakage boundary
Strainer body (Cap and plug)	Leakage boundary
Trap body	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 3.2, 3.6.1.2.2, 6.4.2.2.1, 9.4.12.2.9

License Renewal Drawings: 913-0018

2.3.3.11 Control Complex Chilled Water (P47)

System Description

The control complex chilled water system provides mechanically chilled water to the coils of the following control complex air handling units:

a. Control room.

b. Motor control center, switchgear and miscellaneous areas.

c. Controlled access and miscellaneous equipment areas.

d. Emergency closed cooling pump area.

e. Computer room (to cool the air supplied to the control complex area).

Three 100 percent capacity water chilling machines and three 100 percent capacity water recirculating pumps are provided. These are connected to two redundant chilled water piping systems, one of which is normally operating while the other is on manual standby. Loop A can be connected to chiller A or C, and loop B can be connected to chiller B or C. One set of isolation valves on the main header is normally closed. The other set of isolation valves is normally open to valve chiller C into either pipe loop A or B.

One chiller and one circulating pump are connected to the Division 1 standby diesel generator. Another chiller and circulating pump are connected to the Division 2 standby diesel generator. The third chiller and pump are connected to a non-diesel backed power supply. During all modes of operation, condenser water for the “A” and “B” chillers is provided by the emergency closed cooling system and condenser water for the “C” chiller is provided by the nuclear closed cooling system.

Electric motor-operated isolation valves are also provided to isolate the chilled water coils of the nonsafety-related air handling units to prevent draining the chilled water from the system if a coil failure occurs. The signal from the low level switch in the expansion tank will activate the corresponding isolation valves.

The portion of the system after the isolation valves (F290A, B and F295A, B) is nonsafety-related and non-seismically qualified, however, it will not rupture during a safe shutdown earthquake or an operating basis earthquake.

The control complex chilled water System is classified as Safety Class 3, Seismic Category I.

System Boundary

System components subject to aging management review include ventilation cooling coils and headers, pumps, tanks, valves, and various piping components as shown on the LR boundary drawings. Various chiller subcomponents not shown on the boundary drawings are also subject to aging management review.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

Provide chilled water to safety-related control complex air handling units. [10 CFR 54.4(a)(1), (a)(3) – FP]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Provide chilled water to nonsafety-related control complex air handling units.

Electric motor-operated isolation valves isolate the chilled water coils of the nonsafety-related and non-seismic air handling units to prevent draining the chilled water from the system if a coil failure occurs. [10 CFR 54.4(a)(1)]

Nonsafety-related cooling coils and related piping will not rupture due to an SSE or OBE earthquake. [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

Table 2.3.3-11 lists the component types that require aging management review and their intended functions.

Table 3.3.2-11, Auxiliary Systems – Control Complex Chilled Water System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-11
Control Complex Chilled Water
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Compressor housing	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (Channel)	Pressure boundary, Leakage boundary
Heat exchanger (Shell)	Pressure boundary
Heat exchanger (Tube)	Heat transfer, Pressure boundary
Heat exchanger (Tubesheet)	Pressure boundary
Heat exchanger (Ventilation cooling coil fin)	Heat transfer
Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Leakage boundary, Pressure boundary
Heat exchanger (Ventilation cooling header)	Leakage boundary, Pressure boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary

Component Type	Intended function
Pump casing	Pressure boundary
Separator	Pressure boundary
Sight glass	Pressure boundary
Sight glass (Body)	Pressure boundary
Strainer body	Pressure boundary
Tank	Leakage boundary, Pressure boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 9.4.9.2.1, 9.4.9.3

License Renewal Drawings: 913-0001, 913-0002

2.3.3.12 Control Rod Drive (C11)

System Description

The control rod drive system (CRD) controls gross changes in core reactivity by incrementally positioning neutron absorbing control rods within the reactor core in response to manual control signals. It is also required to quickly shut down the reactor (scram) in emergency situations by rapidly inserting withdrawn control rods into the core in response to a manual or automatic signal from the reactor protection trip system. The control rod drive system consists of locking piston control rod drive mechanisms and the CRD hydraulic system (including power supply and regulation, hydraulic control units, interconnecting piping, instrumentation, and electrical controls).

The CRD mechanism (drive) used for positioning the control rod in the reactor core is a double-acting, mechanically latched, hydraulic cylinder using water as its operating fluid.

The control rod drive hydraulic system supplies and controls the pressure and flow to and from the drives through hydraulic control units (HCUs). The water discharged from the control rod drives during a scram flows through the HCUs to the scram discharge volume. The water discharged from a drive during a normal control rod positioning operation flow through the HCU, then the exhaust header, and is returned to the reactor vessel via the HCUs of non-moving drives. There is one HCU for each control rod drive.

The scram accumulator stores sufficient energy to fully insert a control rod at any vessel pressure. The accumulator is a hydraulic cylinder with a free-floating piston. The piston separates the water on top from the nitrogen below. A check valve in the accumulator charging line prevents loss of water pressure in the event supply pressure is lost.

The scram discharge volume consists of header piping which connects to each HCU and drains into an instrument volume. The header piping is sized to receive and contain all the water discharged by the drives during a scram, independent of the instrument volume.

The alternate rod insertion (ARI) feature is designed to increase the reliability of the control rod drive system scram function. ARI provides for insertion of reactor control rods by depressurizing the scram air header through valves which are redundant and diverse from the reactor protection system scram valves.

System Boundary

System components subject to aging management review include non-Class 1 hydraulic supply pumps, valves, and associated equipment external to the control rod drive housing, the scram discharge volume, and the associated pneumatic components, as shown on LR boundary drawings. The Class 1 control rod drive housings are evaluated with the reactor pressure vessel. The Class 1 control rod drive mechanisms are evaluated with the reactor coolant pressure boundary. The control rod blade assemblies are evaluated with reactor vessel internals.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform functions that demonstrates compliance with the regulations for FP, ATWS, and EQ.

When a scram is initiated by the reactor protection system, the control rod drive system inserts the negative reactivity necessary to shut down the reactor. [10 CFR 54.4(a)(1), (a)(3) - FP]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

System piping penetrating the drywell provide a drywell pressure boundary function. [10 CFR 54.4(a)(1)]

Control rods provide the means for reliable control of reactivity changes.

Scram Discharge Volume (SDV) maintains the reactor coolant pressure boundary following a scram. This includes closure of the vent and drain valves during a scram to limit the amount of reactor coolant discharged so that adequate cooling is maintained, and offsite doses remain within the limits of 10 CFR 100. [10 CFR 54.4(a)(1)]

System contains safety-related indication including control rod position and control rod scram valve indication. [10 CFR 54.4(a)(1), (a)(3) – EQ]

The ARI system provides an electrically diverse scram logic independent of the RPS. [10 CFR 54.4(a)(3) – ATWS]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

Table 2.3.3-12 lists the component types that require aging management review and their intended functions.

Table 3.3.2-12, Auxiliary Systems – Control Rod Drive System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-12
Control Rod Drive
Component Types Subject to Aging Management Review

Component Type	Intended function
Accumulator (Cylinder)	Pressure boundary
Accumulator (End cap)	Pressure boundary
Bolting	Leakage boundary, Pressure boundary
Filter housing	Leakage boundary
Flexible hose	Pressure boundary
Flow restrictor	Leakage boundary
Heat exchanger (Channel)	Leakage boundary
Heat exchanger (Shell)	Leakage boundary
Orifice	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Sight glass	Leakage boundary

Component Type	Intended function
Strainer body	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 1.2.2.4.3, 4.6.1.1.2, Appendix 15C

License Renewal Drawings: 302-0871, 302-0872

2.3.3.13 Control Room HVAC (M25) and Emergency Recirculation (M26)

System Description

The control room HVAC system operates continuously to supply conditioned air, a portion of which is outside air, for ventilation to the control room to dissipate the internal heat load generated and maintain the control room ambient air conditions. During normal plant operation, a system supply and return fan runs continuously, the outside air intake dampers, and the return damper are open, and the exhaust air damper is closed. Either the “A” set or the “B” set of supply and return components is in operation with the idle redundant equipment as backup. The emergency recirculation system is idle and closed off from the HVAC system by its closed discharge damper. Normally, a portion of the supplied air is assumed to exfiltrate from the control room through normal openings, thereby ensuring a positive pressure inside the room.

The main components of this system are located in the control complex and consist of two redundant supply plenums, two redundant supply fans and two redundant return fans, each rated at 100 percent of the total required capacity.

Each supply plenum includes roughing filters and chilled water coils. Each outside air intake duct is provided with redundant dampers in series to reduce the outside air in-leakage when the system is in the emergency recirculation mode. A check damper is provided in the discharge duct of each supply fan. In addition, manually operated balancing dampers for balancing, and fire dampers for fire protection, are provided.

Each return unit consists of a centrifugal fan, an exhaust air isolation damper, a return air isolation damper, manually operated balancing dampers, and fire dampers. The exhaust isolation damper is normally closed and the return isolation damper is normally open.

In the event of high smoke condition, except during a LOOP/LOCA condition, the smoke can be purged by manually setting the mode selector switch in the “smoke clear” mode.

Electric heating coils (with SCR controllers) in the branch supply ducts to the various zones in the control room are provided to control the final ambient air temperature in each zone. An electronic thermostat in each zone is used to provide a signal to the SCR controller which will control the heating coil, depending upon final room temperature.

Humidification is also provided by the control and computer rooms humidification system (M29). An electronic humidity controller, with local indication, is located in the general area of the control room to modulate the electric motor-operated valve on the humidifier.

The fans, filter elements, coils, and dampers of the control room HVAC system are of standard industrial design manufactured in accordance with the Quality Assurance (QA) requirements of Safety Class 3, Seismic Category I items. The filter racks and plenums are specially designed to satisfy system space requirements and also meet the above QA requirements. However, the electric duct heating coils and the humidifiers are nonsafety-related items.

The control room emergency recirculation system routes the supply air through the charcoal filter train before being distributed to the control room. This system is idle during normal plant operation and is automatically activated by an emergency signal (such as LOCA), or high radiation, or by manually setting the mode selector switch to the emergency recirculation mode.

The main components of this system are in the control complex and consist of two 100 percent capacity filter trains. Each filter train includes the following sequential components: demisters, roughing filters, electric heating coil, HEPA prefilters, charcoal filters, HEPA after filters, centrifugal fan, isolation damper, and check damper.

The electric heaters are not required for the control room emergency recirculation system to perform its specified safety function based on the Alternate Source Term analyses.

The fans, filter elements and dampers of the control room emergency recirculation system are of standard industrial design, manufactured in accordance with Quality Assurance (QA) requirements of Safety Class 3, Seismic Category I items. The filter racks, frames and housing are specially designed to satisfy the system space requirements and meet the above QA requirements.

System Boundary

System components subject to aging management review include fan housings, dampers, and other ductwork components supporting control room ventilation as depicted on the LR boundary drawings.

Cooling water and fire protection components are evaluated within control complex chilled water and fire protection systems (P47 and P54, respectively).

Control room envelope is evaluated with structural components.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

Provide cooling, heating, and ventilation for the control room areas and offices [10 CFR 54.4(a)(1), (a)(3) – FP]

Supply filtered air to the control room areas and offices during emergency periods and other abnormal conditions for personnel protection. [10 CFR 54.4(a)(1), (a)(3) – FP]

The control room emergency recirculation system is an engineered safety features (ESF) filter system that reduces the concentration of airborne radioactive contaminants following a design basis accident. [10 CFR 54.4(a)(1)]

System tornado dampers control building pressure transient during a tornado. [10 CFR 54.4(a)(1)]

Provide smoke removal for the control room areas and offices [10 CFR 54.4(a)(3) – FP]

The system contains components within the scope of 10 CFR 50.49 [10 CFR 54.4(a)(3) – EQ]

The control room HVAC system is provided with oxygen monitors which alarm upon detecting a loss of oxygen in the air due to carbon dioxide buildup.

Component Types Subject to Aging Management Review

Table 2.3.3-13 lists the component types that require aging management review and their intended functions.

Table 3.3.2-13, Auxiliary Systems – Control Room HVAC and Emergency Recirculation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-13
Control Room HVAC and Emergency Recirculation
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Filtration
Flexible connection	Pressure boundary

Component Type	Intended function
Flow element	Pressure boundary
Heater housing	Pressure boundary
Piping	Pressure boundary, Leakage boundary
Plenum	Pressure boundary
Valve body	Pressure boundary

References

UFSAR: 3.11.4.1, 6.4.1, 6.4.2, 6.5.1, 9A.3.2

License Renewal Drawings: 912-0610

2.3.3.14 Controlled Access and Miscellaneous Equipment Areas HVAC (M21)

System Description

This ventilation system operates continuously during normal plant operation and during plant shutdown to provide cooling and heating for various areas, and exhaust capabilities for various laboratory hoods and the access area count room. The areas served by this system include the controlled access rooms, miscellaneous areas such as the nuclear closed cooling pump and heat exchanger rooms, emergency closed cooling pump and heat exchanger area, hot laundry area, laboratory hoods, HVAC equipment rooms, and electric maintenance room.

The duct systems and controls are arranged so that a mixture of outside air and return air from the HVAC equipment room is directed through the cooling plenum and is supplied to the various areas requiring cooling or heating. After satisfying the cooling or heating functions, room air from non-contaminated areas is ducted to the return air fan and from there is discharged to the HVAC equipment room. Room air from contaminated or potentially contaminated areas is ducted to the filter system and is then discharged to the unit plant vent. In the event of an emergency, the filter plenum discharge may be remote-manually redirected to a recirculation mode. In this mode, the exhaust from the filter plenum is directed to the supply plenum discussed above, with the outside air damper to the supply plenum closed.

In the event of loss of offsite power or a LOCA, the emergency closed cooling pump and heat exchanger area, and areas housing the chillers and service air compressors are cooled by the emergency closed cooling pump area cooling system (M28).

During normal plant operation and during plant shutdown, power will be provided to this system from the preferred ac source. During periods of emergency, this system is not required to operate to safely shut down the plant.

This system, excluding the filter plenum and tornado dampers, is classified as nonsafety-related and non-seismic category. However, the cooling coils and related piping of this system will not rupture during a safe shutdown earthquake or an operating basis earthquake. The filter plenum is classified as nonsafety-related, Seismic Category I. The tornado dampers are classified as safety-related, non-seismic.

System Boundary

System components subject to aging management review include fire and tornado dampers, ductwork that supports the tornado dampers' function, and filter housing drain piping and valves, as shown on the LR boundary drawing.

Fire protection and chilled water piping are evaluated within those systems (P54 and P47, respectively).

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

System tornado dampers control building pressure transient during a tornado. [10 CFR 54.4(a)(1)]

Selected nonsafety system ducting required to support control building pressure transient during a tornado. [10 CFR 54.4(a)(2)]

System fire dampers limit the spread of fires. [10 CFR 54.4(a)(3) – FP]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Provide ventilation for miscellaneous areas in the control building.

Component Types Subject to Aging Management Review

Table 2.3.3-14 lists the component types that require aging management review and their intended functions.

Table 3.3.2-14, Auxiliary Systems – Controlled Access and Miscellaneous Equipment Areas HVAC System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-14
Controlled Access and Miscellaneous Equipment Areas HVAC Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Filter housing	Leakage boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.4.1.1.3, 9.4.1.2.3,9A.4.4

License Renewal Drawings: 912-0608

2.3.3.15 Diesel Generator and Auxiliaries (R43, R44, R45, R46, R47 & R48)

System Description

Note: Some division 3 diesel generator subsystems are assigned to the high pressure core spray Division 3 plant system (E22) but are evaluated with Division 1 & 2 diesels in systems R43 thru R48.

The Class 1E power system is designed with three independent divisions, each provided with a diesel engine driven, 4.16 kV, 3 phase, 60 Hz synchronous generator. Division 1 and Division 2 are redundant while Division 3 supplies power for the high pressure core spray system (HPCS). Division 3 is capable of being manually cross-tied to Division 2 during a station blackout to provide power to some Division 2 loads. Additionally, Division 3 is capable of being manually connected to Division 1 following a loss of coolant accident and a total loss of both the normal and emergency Division 1 AC electrical power sources, to provide power to the motor operated gate valves in the feedwater lines.

The diesel generator sets are electrically and physically isolated from each other and are located in a Seismic Category I structure adjacent to the control complex.

The continuous rating of the Division 1 and 2 diesel generators is 7,000 kW, while the Division 3 diesel generator is rated at 2600 kW. The Division 1 and 2 diesel generators were manufactured by Transamerica Delaval, Inc.

The HPCS (Division 3) diesel generator is a 20 cylinder EMD diesel generator equipped with a turbocharger. The HPCS system and its power supply unit is part of the ECCS. HPCS and the diesel generator by itself does not meet the single failure criterion, although the criterion is applicable at the ECCS level.

While the Division 3 diesel is not identical to the Division 1 and 2 diesels, each diesel has associated starting air, fuel oil, jacket cooling water, lubricating oil, and intake & exhaust subsystems. The scoping and aging management reviews are grouped by subsystem, and each subsystem addresses all three diesels.

Control Air (R43 – Division 1 and 2)

Control air for the Division 1 and 2 diesel generator protective features is supplied from the starting air system's air receiver.

The Division 1 and 2 diesel generator control air system functions to trip the diesel generators in the event of abnormal engine operating conditions. Nonessential trip functions are bypassed upon receipt of a LOCA or bus under/degraded voltage signal but will shut down the diesel generators when operating in all other modes. Only the generator differential and overspeed trip functions will shut down the diesel generators after a start resulting from a LOCA or bus under/degraded voltage signal. Categorically, the Division 1 and 2 diesel generator control air system functions to support starting and operation of the diesel generators.

Starting Air (R44)

Separate and independent starting air subsystems are provided for each of the three diesel generators; each subsystem is designed for complete redundancy and can supply enough air for a minimum of five consecutive engine starts.

The starting air subsystem for each diesel generator includes two redundant trains of components/piping. Each train has an air compressor, aftercooler, air dryer, and a receiver tank.

Fuel Oil (R45)

Separate fuel oil storage and transfer facilities are provided for each of the three diesel generators for at least seven days of operation carrying the design electrical load of the associated generator.

The standby diesel generators and the HPCS diesel generator each have an associated fuel oil storage and transfer system which consists of one diesel fuel oil storage tank, one fuel oil day tank, two transfer pumps, a motor-driven fuel oil pump, an engine driven fuel oil pump, and necessary piping, valves, strainers, filters, and instrumentation. The fuel storage tanks are buried, horizontal, cylindrical, atmospheric tanks.

The fuel oil storage tanks are designed so that all openings are above the ground water and Probable Maximum Flood (PMF) levels to prevent the entrance of water.

The fuel oil day tanks are 550 gallon (555 gallon for the HPCS diesel), vertical, cylindrical, atmospheric tanks mounted in the respective standby diesel generator room. The transfer pumps transport fuel between the underground storage tank and the day tank. The transfer pumps are located in the respective diesel generator room. Each pump is powered from a safety-related Class 1E 480 volt motor control center and has a capacity of 90 gpm. An overflow line is provided from the day tank to the associated diesel fuel oil storage tank to provide a closed recirculation loop. Because the day tanks are always full, corrosion of these tanks are minimized.

One engine-driven fuel oil booster pump and one motor-driven fuel oil booster pump are supplied with and located on each diesel engine. Each fuel oil booster pump supplies fuel from the day tank to the engine manifolds and starts when the diesel start signal is received. The fuel pumps draw more fuel oil from the day tank than is consumed by the engine. The excess fuel is returned to the day tank by a separate return line.

Cooling Water (R46)

The standby diesel generators (Division 1 & 2) are of a different manufacturer than the HPCS diesel generator (Division 3), but all three diesels utilize similar cooling systems.

The diesel generator cooling system is designed to remove heat generated by the diesel generator assembly during operation. The cooling system removes heat from the water jackets, the lube oil heat exchanger, and the turbocharger inter/aftercoolers. Additionally, the Division 1 and 2 standby diesel generators include a governor oil cooler not present on the Division 3 HPCS diesel. The coolant consists of demineralized water with corrosion inhibiting additives. Ethylene glycol may be added as allowed by manufacturer’s recommendations. Heat removed from the system is transferred to the emergency service water system. The cooling system for each diesel generator includes a standpipe/expansion tank. Each cooling system also includes an electric heat source and recirculation method for maintaining the engines warm when not running.

Lube Oil (R47)

The standby diesel generators (Division 1 & 2) are of a different manufacturer than the HPCS diesel generator (Division 3), but all three diesels utilize lubricating oil systems.

Each diesel generator lubrication system is designed to supply lube oil to the engine bearing surfaces at controlled pressure, temperature and cleanliness conditions. The systems include provisions for keeping the bearings flooded and the oil warm for fast start purposes. The system provides lubricating oil to the diesel engine and rejects the heat picked up during circulation to the diesel jacket water cooling system via the lube oil cooler. The turbochargers are equipped with pre-lubrication systems to minimize wear incurred during engine starts.

Air Intake and Exhaust (R48)

The standby diesel generators (Division 1 & 2) are of a different manufacturer than the HPCS diesel generator (Division 3), but all three diesels utilize similar intake air and exhaust systems.

The diesel generator combustion air intake and exhaust subsystem supplies air of reliable quality to the diesel generators and exhausts the products of combustion from the diesel generators through missile barriers to the atmosphere. The diesel generator combustion air intake and exhaust system is safety related, except for the exhaust silencers and associated exhaust piping outside of the diesel building which are nonsafety-related. The exhaust silencers are nonsafety grade since any blockage of the silencer would be automatically bypassed through the missile barrier discharge.

The combustion air intake and exhaust system consists of air intake filters, intake silencers (the HPCS diesel silencer is integral with its intake filter), expansion joints, exhaust silencers, and associated piping connecting the equipment. The system also contains the diesel engine turbochargers, which utilize diesel exhaust energy to compress the combustion intake air stream.

System Boundary

Control Air (R43)

System components subject to aging management review include safety related valves, and various piping and tubing components that comprise the Division 1 and 2 diesel control air system pressure boundary, as well as nonsafety-related tubing and piping components that provide a leakage boundary or structural integrity function as shown on the LR boundary drawings.

Starting Air (R44)

System components subject to aging management review include safety related tanks (air accumulators and air receivers), valves, and various piping components that supply starting air from the receivers to the diesels (and control air for Division 1 & 2), as well as nonsafety-related moisture separators and various piping components that provide a leakage boundary or structural integrity function as shown on the LR boundary drawings.

Fuel Oil (R45)

System components subject to aging management review include safety related tanks, pumps, valves, and various piping components that supply fuel oil from the buried tanks to the diesels, as well as nonsafety-related piping components that provide a leakage boundary or structural integrity function as shown on the LR boundary drawings.

Building and yard piping penetrations that perform an external flood mitigation function are addressed as part of structural scoping.

Cooling Water (R46)

System components subject to aging management review include safety related tanks, pumps, valves, and various piping components that supply jacket cooling water to the diesels, as well as nonsafety-related piping components that provide a leakage boundary or structural integrity function as shown on the LR boundary drawings.

Lube Oil (R47)

System components subject to aging management review include safety-related tanks (sumps), pumps, valves, filter and strainer housings, strainer elements, and various piping components that supply lube oil to the diesels, as well as small sections of nonsafety-related piping that provide a leakage boundary or structural integrity function as shown on the LR boundary drawings.

Air Intake and Exhaust (R48)

System components subject to aging management review include safety-related filters, intake silencers, turbochargers, and various piping components that direct the diesel intake air and exhaust, as well as small sections of nonsafety-related piping that provide a structural integrity function as shown on the LR boundary drawings.

Diesel generator room ventilation is addressed with the diesel generator building ventilation (M43) system. The Class 1E power system is addressed as part of electrical scoping. The diesel generator exhaust hallway structure and its insulated panels are evaluated under structural scoping. Building penetrations that perform an external flood mitigation function are addressed as part of structural scoping.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP and SBO.

Supplies independent AC power to the Class 1E 4.16 KV bus. [10 CFR 54.4(a)(1), (a)(3) – FP (Div. 1 & 2 only), (a)(3) – SBO (Div. 3)]

The Division 1 and 2 diesel generator control air, starting air, fuel oil, jacket water cooling, lube oil, intake and exhaust subsystems are all primary support systems for the Division 1 and 2 diesel generators. [10 CFR 54.4(a)(1), (a)(3) – FP]

The Division 3 (HPCS) diesel generator starting air, fuel oil, jacket water cooling, lube oil, intake and exhaust subsystems are all primary support systems for the HPCS diesel generator. [10 CFR 54.4(a)(1), (a)(3) – SBO]

Starting air (right or left bank) provides air to start all three DGs and provides air for the pneumatic control subsystems for the Division 1 and 2 DGs. [10 CFR 54.4(a)(1)]

The Division 1 and 2 diesel generator control air system functions to support starting and operation of the diesel generators. [10 CFR 54.4(a)(1)]

The fuel oil subsystem supplies fuel oil from the day tank to the engine, and transfers fuel oil from the storage tank to the day tank. [10 CFR 54.4(a)(1)]

The jacket water cooling subsystem removes heat during engine operation and keeps the engine warm while in standby. [10 CFR 54.4(a)(1)]

The lube oil subsystem supplies lube oil during engine operation, and during standby operation keeps the bearings flooded and the oil warm. [10 CFR 54.4(a)(1)]

The DG intake and exhaust subsystem provides combustion air and exhaust gas. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Division 3 diesel generator flame arrestors prevent the ignition of flammable vapors on one side of the arrestor if the other side is exposed to an ignition source.

Division 1 and 2 diesel generator flame arrestors prevent the ignition of flammable vapors on one side of the arrestor if the other side is exposed to an ignition source. [10 CFR 54.4(a)(3) – FP]

Component Types Subject to Aging Management Review

Table 2.3.3-15a through 15e list the component types that require aging management review and their intended functions.

Table 3.3.2-15a through 15e, Auxiliary Systems – Diesel Generator and Auxiliaries – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-15a
Diesel Generator and Auxiliaries –
Starting Air (R44) and Division 1 and 2 Control Air (R43)
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary, Structural integrity
Filter housing	Pressure boundary
Flexible hose	Pressure boundary
Lubricator body	Pressure boundary
Manometer	Pressure boundary
Manometer (Glass)	Pressure boundary
Moisture separator	Leakage boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
Starting air motor housing	Pressure boundary
Strainer body	Pressure boundary
Tank (Accumulator)	Pressure boundary
Tank (Air receiver)	Pressure boundary
Valve body	Leakage boundary, Pressure boundary, Structural integrity

Table 2.3.3-15b
Diesel Generator and Auxiliaries – Fuel Oil (R45)
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary, Structural integrity
Drip pan	Leakage boundary
Eductor	Pressure boundary
Filter housing	Pressure boundary
Flame arrestor	Pressure boundary
Flexible hose	Pressure boundary
Orifice	Flow restriction, Pressure boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
Pump casing	Pressure boundary
Strainer body	Pressure boundary
Strainer element	Filtration
Tank	Pressure boundary
Valve body	Leakage boundary, Pressure boundary

Table 2.3.3-15c
Diesel Generator and Auxiliaries – Cooling Water (R46)
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Flexible connection	Leakage boundary, Pressure boundary
Heat exchanger (Channel)	Pressure boundary
Heat exchanger (Shell)	Pressure boundary
Heat exchanger (Tube)	Heat transfer, Pressure boundary
Heat exchanger (Tube fin)	Heat transfer
Heat exchanger (Tubesheet)	Pressure boundary
Heater housing	Pressure boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Sight glass (Body)	Pressure boundary
Tank	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-15d
Diesel Generator and Auxiliaries – Lube Oil (R47)
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Filter housing	Pressure boundary
Heater housing	Pressure boundary
Orifice	Flow restriction, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Sight glass (Body)	Pressure boundary
Strainer body	Pressure boundary
Strainer element	Filtration
Tank	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-15e
Diesel Generator and Auxiliaries – Air Intake and Exhaust (R48)
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary, Structural integrity
Filter element	Filtration
Filter housing	Pressure boundary
Flexible connection	Pressure boundary
Heat exchanger (Turbocharger Channel)	Pressure boundary
Piping	Pressure boundary, Structural integrity
Intake silencer housing	Pressure boundary
Turbocharger housing (Compressor)	Pressure boundary
Turbocharger housing (Turbine)	Pressure boundary
Valve body	Pressure boundary

References

Control Air (R43) and Starting Air (R44):

UFSAR: 8.3.1.1.3.1, 8.3.1.1.3.2, 8.3.1.1.3.3, 8.3.1.1.2, Figure 8.3-6, 9.5.6.1, 9.5.9.3.1, Appendix 15H

License Renewal Drawings: 302-0346, 302-0347, 302-0348, 302-0349, 302-0351, 302-0355, 302-0357, 302-0358

Fuel Oil (R45):

UFSAR: 9.5.4.1, 9.5.4.2, 9.5.4.3, 9.5.9.1.1, 9.5.9.1.2, 9.5.9.1.3, 9A.4.9.1.2

License Renewal Drawings: 302-0347, 302-0349, 302-0352, 302-0356

Cooling Water (R46):

UFSAR: 9.5.5.1, 9.5.5.2, 9.5.9.2.1, 9.5.9.2.2

License Renewal Drawings: 302-0347, 302-0349, 302-0354, 302-0355, 302-0360

Lube Oil (R47):

UFSAR: 9.5.7, 9.5.9.4

License Renewal Drawings: 302-0346, 302-0347, 302-0348, 302-0349, 302-0353, 302-0359

Air Intake and Exhaust (R48):

UFSAR: 9.5.8.1, 9.5.9.5.1, 9.5.8.2, 9.5.9.5.2

License Renewal Drawings: 302-0346, 302-0347, 302-0348, 302-0349, 302-0355

2.3.3.16 Diesel Generator Building Ventilation (M43)

System Description

The diesel generator building ventilation system (DGBVS) operates whenever the diesel generators operate (following loss of offsite power signal and following a LOCA signal) or during testing of the DGBVS, except for the auxiliary exhaust fans, which operate only when the associated diesel generator is not running.

The DGBVS for each diesel generator room consists of two 100 percent capacity supply air fans, two sets of exhaust louvers, outside air and return air dampers, ductwork arranged for cooling the diesel generators and related equipment, and a nonsafety-related auxiliary exhaust fan. Inactive supply fans are isolated by automatically controlled outside air dampers. However, when neither fan operates, the outside air and recirculation dampers automatically modulate to promote natural ventilation. The exhaust louver closest to the auxiliary exhaust fan is maintained open during exhaust fan operation. The exhaust fan withdraws air from the diesel room to further promote cooling during diesel standby conditions. When the CO2 system is activated, outside air and exhaust air dampers close, the return air dampers open and the ventilation fans stop.

Electric unit heaters are also provided to maintain the minimum room temperature when the diesel generators are not operating.

The auxiliary exhaust fans are not safety-related and are not backed with emergency power, nor are they relied upon for operation during accident conditions.

The DGBVS system is classified as Safety Class 3 and Seismic Category I.

System Boundary

System components subject to aging management review include safety-related fans, dampers, and associated ductwork as shown on the LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP and SBO.

Remove heat generated by the diesel engine and auxiliary equipment and maintain room temperature. [10 CFR 54.4(a)(1), (a)(3) – FP, SBO]

Isolate ventilation upon CO2 actuation to support fire suppression. [10 CFR 54.4(a)(3) – FP]

Component Types Subject to Aging Management Review

Table 2.3.3-16 lists the component types that require aging management review and their intended functions.

Table 3.3.2-16, Auxiliary Systems – Diesel Generator Building Ventilation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-16
Diesel Generator Building Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Flexible connection	Pressure boundary

References

UFSAR: 3.11.4.4, 9.4.5.1.4, 9.4.5.2.4, Appendix 9A.4.5.1, Appendix 15H

License Renewal Drawings: 912-0619

2.3.3.17 ECCS Pump Room Cooling (M39)

System Description

Each emergency core cooling system (ECCS) air handling unit operates whenever the associated pump operates. These operating periods occur during normal shutdown, during emergency or LOCA shutdown or during hot standby conditions. The ECCS pump room cooling system (ECCSCS) includes one air handling unit for each room to recirculate air and provide cooling for the RHR A pump and heat exchanger room, RHR B pump and heat exchanger room, RHR C pump room, HPCS pump room, LPCS pump room, and RCIC pump room. Each air handling unit is capable of removing 100 percent of the cooling requirements of the ECCS pump and related equipment. The dissipated heat for all air handling units except the HPCS is removed by the emergency closed cooling water system. The HPCS air handling unit is served by the emergency service water system. Each air handling unit includes roughing filters, cooling coils, a fan section and is located so that air is discharged directly toward the ECCS pumps and returns un-ducted to the operating air handling unit.

System Boundary

System components subject to aging management review are air handling units (filter/cooler/fan plenums).

Emergency closed cooling water and emergency service water fluid components (including cooling coils within the air handling units) are evaluated within emergency closed cooling (P42) and emergency service water (P45) systems, respectively.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP, SBO, ATWS and EQ.

Remove heat generated by the RHR pumps, HPCS pumps, LPCS pumps, RCIC pumps, piping, and auxiliary equipment. [10 CFR 54.4(a)(1), (a)(3) – FP, SBO, ATWS]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Component Types Subject to Aging Management Review

Table 2.3.3-17 lists the component types that require aging management review and their intended functions.

Table 3.3.2-17, Auxiliary Systems – ECCS Pump Room Cooling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-17
ECCS Pump Room Cooling
Component Types Subject to Aging Management Review

Component Type	Intended function
Air handling unit housing	Pressure boundary

References

UFSAR: 9.4.5.1.3, 9.4.5.2.3, Appendix 15C, Appendix 15H

License Renewal Drawings: 912-0616

2.3.3.18 Emergency Closed Cooling (P42)

System Description

An emergency closed cooling (ECC) system serves Unit 1 and is designed to provide a reliable source of cooling water to safety-related components required for certain modes of normal reactor operation, as well as for accident conditions and loss of normal auxiliary power. The system is divided into two separate loops. The emergency closed cooling system is a closed system that has its heat exchangers cooled by the emergency service water system.

ECC A loop supplies cooling water to the low pressure core spray room cooler, RHR A pump and room cooler, RCIC room cooler, control complex chiller A, and hydrogen analyzer A. ECC Loop B supplies RHR B and C pumps and room coolers, control complex chiller B and hydrogen analyzer B. The ECC system provides seal water cooling to RHR pumps A, B and C whenever the RHR pumps are running. System design permits seal cooling under all operating modes, including post-accident conditions.

The emergency closed cooling system has two independent loops, each consisting of one pump, heat exchanger and a surge tank. A chemical addition tank is shared by both loops. The pumps may be operated from the preferred offsite power supply or from a standby onsite power source.

The ECC components associated with control complex chiller C do not provide a path for the emergency closed cooling system water, but instead provide the flow path and instrumentation for the supply of nuclear closed cooling water to the control complex chiller C.

The ECC system piping and components associated with Unit 2 serves to provide cooling water to the fuel pool heat exchangers following a design basis accident, if required. This portion of the Unit 2 ECC piping is connected to the Unit 1 emergency service water system. Unit 2 ECC pumps and heat exchangers provide structural support for ECC components/piping.

The emergency closed cooling system is classified as Safety Class 3 and Seismic Category I. Its primary safety function is to support the emergency core cooling system and other safety-related equipment following an accident.

System Boundary

System components subject to aging management review include the pumps, tanks, heat exchangers, valves, and various piping components associated with the ECC system as shown on the LR boundary drawings. Unit 2 and common ECC piping provides a pressure boundary function for the emergency service water system.

Heat exchangers shown on emergency closed cooling system (P42) drawings but associated with the control complex chilled water system (P47) are evaluated with the P47 system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for fire protection, environmental qualification, and anticipated transients without scram.

Safety-related Unit 2 and common ECC piping shown on Scoping Boundary Drawing 352-0621 provides a pressure boundary function for the emergency service water system during both normal/accident conditions. [10 CFR 54.4(a)(1)]

Remove heat from various ECCS and safety-related components. [10 CFR 54.4(a)(1), (a)(3) – FP, (a)(3)- ATWS]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components credited for EQ. [10 CFR 54.4(a)(3) - EQ]

Component Types Subject to Aging Management Review

Table 2.3.3-18 lists the component types that require aging management review and their intended functions.

Table 3.3.2-18, Auxiliary Systems – Emergency Closed Cooling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-18
Emergency Closed Cooling
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary, Structural integrity
Flexible hose	Leakage boundary
Heat exchanger (Channel)	Pressure boundary
Heat exchanger (Shell)	Pressure boundary, Structural integrity
Heat exchanger (Tube)	Heat transfer, Pressure boundary
Heat exchanger (Tubesheet)	Pressure boundary
Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary
Heat exchanger (Ventilation cooling coil fin)	Heat transfer
Heat exchanger (Ventilation cooling header)	Pressure boundary

Component Type	Intended function
Orifice	Flow restriction, Pressure boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
Pump casing	Pressure boundary, Structural integrity
Seal cooler (RHR pump - Shell and cover)	Pressure boundary
Seal cooler (RHR pump - Tube)	Heat transfer, Pressure boundary
Sight glass	Leakage boundary
Sight glass (Body)	Leakage boundary
Tank	Leakage boundary, Pressure boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 9.2.1.2, 9.2.2.1, 9.2.2.2, 9.2.2.3, 9.2.2.6, 9.4.9.2.1, Appendix 15C.3

License Renewal Drawings: 302-0621, 302-0622, 302-0832, 302-1001, 352-0621

2.3.3.19 Emergency Closed Cooling Pump Area HVAC (M28)

System Description

The emergency closed cooling pump area cooling system (ECPCS) operates whenever the Emergency Closed Cooling pumps operate (normal shutdown and emergency shutdown) or during testing of the ECPCS. The ECPCS consists of two 100 percent capacity air handling units and supply distribution ducts for recirculating air and for cooling the ECC pumps and related equipment. The dissipated heat is removed by cooling water from the safety-related chilled water system. Each air handling unit includes roughing filters, cooling coils and a fan section. Supply ducts from each air handling unit are extended to the ECC pump areas. The cooling air returns un-ducted to the operating air handling unit.

System Boundary

System components subject to aging management review include fans, duct, filter/cooler (air handling unit) housings, and dampers associated with the emergency closed cooling pump area, as shown on the LR boundary drawing.

Cooling water components associated with the air handling units are evaluated in the control complex chilled water system (P47).

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

Remove heat generated by ECC pumps and heat exchangers, instrument and service air compressors, and control complex chillers and pumps. [10 CFR 54.4(a)(1), (a)(3) – FP]

System fire dampers prevent the spread of fire. [10 CFR 54.4(a)(3) – FP]

Component Types Subject to Aging Management Review

Table 2.3.3-19 lists the component types that require aging management review and their intended functions.

Table 3.3.2-19, Auxiliary Systems – Emergency Closed Cooling Pump Area HVAC System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-19
Emergency Closed Cooling Pump Area HVAC
Component Types Subject to Aging Management Review

Component Type	Intended function
Air handling unit housing	Pressure boundary
Bolting	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Flexible connection	Pressure boundary

References

UFSAR: 9.4.5.1.2, 9.4.5.2.2, Appendix 9A.3.2

License Renewal Drawings: 912-0623

2.3.3.20 Emergency Service Water (P45)

System Description

The emergency service water system is comprised of independent Loops A, B and C. The loops are defined as follows, with each loop supplying emergency service water to the equipment listed:

Loop A	**Loop B**	**Loop C**
RHR Heat Exchangers A & C	RHR Heat Exchangers B & D	HPCS Diesel Generator Heat Exchanger
Standby Diesel Generator A	Standby Diesel Generator B	HPCS Pump Room Cooler
Emergency Closed Cooling Heat Exchanger A	Emergency Closed Cooling Heat Exchanger B	
Fuel Pool Cooling Heat Exchanger A	Fuel Pool Cooling Heat Exchanger B	

These open loops take suction from Lake Erie. Each loop is supplied by a separate pump which is operated from a preferred power source or a standby power source (diesel-generator).

Initiation of the emergency service water system is accomplished by automatic signal or remote-manual action, depending upon the operational requirements. Specifically, all loops of the system are initiated automatically by LOCA signals or by loss of power to the associated 1E bus. Loop C is initiated automatically with the initiation of the HPCS system. Loop A is initiated automatically with the initiation of the RCIC system. Remote-manual action can be employed at any time but is not necessary for normal over-all plant operations.

As a contingency measure, the ESW system A and B Loops can be lined up to provide cooling water to the fuel pool cooling and clean-up heat exchangers (FPCC HXs) and ESW system B loop can be lined up to allow for containment flood during post-accident recovery.

A connection off the ESW system B loop is provided to accept a 1-1/2 inch fire hose which can be connected to the standby liquid control transfer system. This arrangement is to provide an emergency backup water supply to the standby liquid control auxiliary mixing tank.

The ESW system is provided with connections to the fire protection system. This arrangement provides a backup water supply to hose stations in the vicinity of safety shutdown equipment.

The emergency service water pumps, located in the emergency service water pumphouse, are of the vertical type. Emergency service water to the pump intake structure is taken from Lake Erie. The primary source of water to the emergency service water pumphouse is supplied by a branch tunnel taken off the main intake tunnel to the service water pumphouse. A backup supply is available by means of a branch tunnel from the main discharge tunnel. Should normal emergency service water (ESW) supply from the intake tunnel be interrupted, sluice gates open automatically upon receiving a low water level signal from the ESW pumphouse forebay, allowing water from the discharge tunnel to flow into the forebay and supply the ESW system. Upon indication on a control room panel that the sluice gates are open, manual valves will be administratively closed to prevent warm ESW from dumping to the discharge tunnel. With the manual valves closed, the ESW system discharges to the swale.

The applicable safety class for all ESW system equipment is Safety Class 3, except for the equipment that interfaces with the RHR system, which is Safety Class 2 (Containment Flooding Mode). The appropriate seismic criteria are Seismic Category I.

System Boundary

System components subject to aging management review include the pumps, heat exchangers, valves, and various piping components associated with the ESW system as shown on the LR boundary drawings.

Heat exchangers associated with the HPCS D/G, RHR, and ECC systems are evaluated with those systems. The intake and discharge tunnels, and the forebay and sluice gates are evaluated as structural components.

Unit 2 and Common emergency closed cooling system (P42) piping that directs ESW cooling water to and around the FPCC heat exchangers is evaluated under the P42 ECC system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for fire protection, station blackout, anticipated transients without scram, and environmental qualification.

Provide a reliable source of water to safety-related components required for certain modes of normal reactor operation, as well as for accident conditions and loss of normal auxiliary power. [10 CFR 54.4(a)(1) & (a)(3) - FP, (a)(3) - SBO (Division 3 D/G), (a)(3) - ATWS (cooling water for RHR A/B)]

Flood the containment for post-accident recovery (loop B only). [10 CFR 54.4(a)(1)]

Provide emergency makeup to the fuel pool cooling and cleanup system surge tank (loops A and B). [10 CFR 54.4(a)(1)]

De-ice the emergency service water pumphouse traveling screens (loops A and B). [10 CFR 54.4(a)(1)]

ESW sluice gates provide a barrier between the discharge tunnel and the ESW pumphouse forebay to prevent recirculation of plant discharge water thereby maintaining the ESW forebay at or below its maximum allowable temperature during all modes of plant operation including accident and transient mitigation. [10 CFR 54.4(a)(1)]

ESW suction sluice gates open automatically or manually to provide emergency water supply from discharge tunnel to ESW pump forebay upon low water level in ESW forebay. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) - EQ]

Provide emergency makeup to the emergency closed cooling system surge tanks (loops A and B).

Provide a seismic backup water supply to fire protection system (loops A and B).

Provide backup water supply to standby liquid control auxiliary mixing tank (loop B only).

Provide emergency makeup source for the diesel jacket water cooling systems (Div. 1 and Div. 2).

Component Types Subject to Aging Management Review

Table 2.3.3-20 lists the component types that require aging management review and their intended functions.

Table 3.3.2-20, Auxiliary Systems – Emergency Service Water System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-20
Emergency Service Water
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Flexible hose	Pressure boundary
Heat exchanger (Pump motor cooler tube)	Heat transfer, Pressure boundary

Component Type	Intended function
Heat exchanger (Pump motor oil reservoir)	Pressure boundary
Heat exchanger (Ventilation cooling coil fin)	Heat transfer
Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary
Heat Exchanger (Ventilation cooling header)	Pressure boundary
Orifice	Flow restriction, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary, Pressure boundary
Pump casing (Suction bell)	Pressure boundary
Sight glass	Leakage boundary, Pressure boundary
Sight glass (Body)	Leakage boundary, Pressure boundary
Strainer body	Pressure boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 9.2.1.1, 9.2.1.2, 9.5.5.3, Appendix 15C.3

License Renewal Drawings: 302-0791, 302-0792

2.3.3.21 Emergency Service Water Pump House Ventilation (M32)

System Description

The ESWVS consists of two 100 percent capacity supply fans, two operating relief louvers and supply ductwork with return dampers for cooling the ESW pumps and auxiliary equipment. The supply fans and duct are arranged so that cooling air is admitted to the south end of the building and after absorbing heat is relieved to the outside at the north end of the building. The amounts of outside air and recirculated return air used for cooling are automatically controlled by outside air and return air dampers.

Electric unit heaters are also provided to maintain the minimum room temperature when the ESW pumps are not operating.

Blocked closed Unit 2 Fan inlet dampers 2M32F0040A/B are structural components of the ESWPH wall and act as a barrier to air flow following a design basis tornado.

System Boundary

System components that are subject to aging management review include fans, dampers and ductwork associated with the ESW pumphouse, as shown on the LR boundary drawing.

The "fixed louvers" and "blocked closed Unit 2 Fan inlet dampers" shown on the boundary drawing are attached to the ESW building wall and are covered as part of the structural scoping.

Electric Unit Heaters are evaluated under P55 building heating system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

Remove the heat generated by the emergency service water pumps and auxiliary pump room equipment. System is started automatically when the ESW pumps operate. [10 CFR 54.4(a)(1), (a)(3) – FP]

Component Types Subject to Aging Management Review

Table 2.3.3-21 lists the component types that require aging management review and their intended functions.

Table 3.3.2-21, Auxiliary Systems – Emergency Service Water Pump House Ventilation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-21
Emergency Service Water Pump House Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary

References

UFSAR: 9.4.5.1.1, 9.4.5.2.1, Appendix 9A.3.2

License Renewal Drawings: 912-0630

2.3.3.22 Emergency Service Water Screen Wash (P49)

System Description

The ESW screen wash system traveling screens and their associated screen wash pumps, are automatically started electrically by a LOCA signal and will run continuously until the signal is cleared. The screen wash strainers are driven by nonsafety-related motors from safety-related power supplies. Therefore, these motors are prohibited from being operated electrically by the same LOCA signal discussed above. During a LOCA event, the screen wash strainer high differential pressure alarm will be monitored, and manual backwashing of the strainers will be performed as required. During a LOOP event, system logic and annunciator power are lost, necessitating a manual system startup. In the event of a LOCA concurrent with a LOOP, the traveling screens and their associated pumps will automatically start, and the screen wash strainers will be electrically prohibited from operating.

Operation of only one screen wash subsystem will ensure that one traveling screen is always kept clean at all times. One screen is enough to provide the flow requirements for all ESW pumps and fire protection pumps.

System Boundary

System components subject to aging management review are the safety-related screen wash pumps, strainers, traveling screens, and piping components within the emergency service water pumphouse as shown on the LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

Remove debris from water entering the ESW pump suction bays. [10 CFR 54.4(a)(1), (a)(3) – FP]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

Table 2.3.3-22 lists the component types that require aging management review and their intended functions.

Table 3.3.2-22, Auxiliary Systems – Emergency Service Water Screen Wash System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-22
Emergency Service Water Screen Wash
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Nozzle	Flow control
Piping	Leakage boundary, Pressure boundary
Pump casing (Bowl)	Pressure boundary
Pump casing (Column)	Pressure boundary
Strainer body	Pressure boundary
Traveling screen	Filtration
Valve body	Pressure boundary

References

UFSAR: 9.2.1.3

License Renewal Drawings: 302-0214

2.3.3.23 Feedwater Zinc Injection (P85)

System Description

The zinc injection system consists of a zinc injection skid which injects a dilute concentration of zinc oxide into the feedwater. A stream of water taken from the feedwater pump discharge is routed through a column containing zinc oxide pellets. The dissolution of the zinc pellets into the diverted feedwater stream provides the dilute concentration of zinc oxide. The dilute zinc oxide solution is returned to the feedwater pump suction and is blended with the main feedwater flow.

The zinc transported in the reactor water replaces Co-60 as the species in the oxide film layer formed on stainless steel. Lower Co-60 build-up results in lower radiation levels in such areas as the drywell and the reactor water cleanup pump rooms.

The zinc injection system is nonsafety-related and is not required for safe shutdown of the reactor.

System Boundary

System components subject to aging management review include nonsafety-related valves and piping components in areas containing safety-related components.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Reduce radiation levels in such areas as the drywell and the reactor water cleanup pump rooms.

Component Types Subject to Aging Management Review

Table 2.3.3-23 lists the component types that require aging management review and their intended functions.

Table 3.3.2-23, Auxiliary Systems – Feedwater Zinc Injection System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-23
Feedwater Zinc Injection
Component Types Subject to Aging Management Review

Component Type	Intended function
Filter housing	Leakage boundary
Heat exchanger (Channel)	Leakage boundary
Heat exchanger (Shell)	Leakage boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.3.7.1, 9.3.7.2, 9.3.7.3

License Renewal Drawings: 302-0335

2.3.3.24 Fire Protection (P54)

System Description

The following list provides a general description of the types of fire protection piping systems at PNPP and identifies the areas or hazards protected by each type:

a. Wet pipe automatic sprinkler system: Major components - alarm check valve, water flow pressure switch, shutoff valve with position switch.

    1. Turbine building below the operating floors, including areas beneath the turbine condenser.
    2. Diesel fire pump room in the emergency service water pumphouse.
    3. Radwaste storage and processing areas at Elevation 623’-6” of the radwaste building.
    4. Reactor core isolation cooling pump room at Elevation 574’-10” of the auxiliary building.
    5. Control complex at Elevation 599’-0” and the southern portion of Elevation 574’-10”.
    6. Service building, service building annex and technical support center, except CAS and Halon protected areas.
    7. Auxiliary boiler building.
    8. Fuel oil pumphouse.
    9. Intermediate building above Elevation 599’-0” excluding the instrument storage area and hot instrument shop.
    10. Intermediate building above Elevation 620’ excluding the Standby Liquid Control System area.
    11. Auxiliary building 620’ elevation in corridor at west end.
    12. Intermediate building Elevation 574’-10” in the tool decontamination and storage areas.

13. Sprinklers have been provided in other plant buildings where the fire hazard makes it necessary to detect a fire before it can propagate to plant structures, systems or components important to safety located in other buildings.

b. Water spray system: Major components - strainers, deluge valves, shutoff valve with position switch, waterflow pressure switch, control panel, spray nozzles, and heat detectors.

   1. Outdoor oil-filled transformers.

   2. Charcoal filter systems.

   3. Hydrogen seal oil units at Elevation 605'-0" of the turbine building.

c. Preaction water spray systems: Major components - strainers, deluge valves, waterflow pressure switch, shutoff valve with position switch, fusible element type spray nozzle, control panel, heat detectors, and supervised air supply.

   1. Turbine generator bearings.

   2. Feedwater pump turbine bearings at Elevation 647'-0" of the heater bay.

d. Preaction sprinkler system: Major components - strainer, deluge valve, waterflow pressure switch, shutoff valve with position switch, sprinklers, fusible element type spray nozzles, control panel, heat detectors, and a supervised air supply.

   Two systems exist: one for each cable spreading room (i.e., Unit 1, Division 1 and Division 2; Unit 2, Division 1 and Division 2). These systems also cover the control complex cable chases, cable tunnels and penetration areas.

e. Carbon dioxide total flooding system: Major components - low pressure CO2 tank, master valve, selector valve, control panel, fire detectors, and discharge nozzles.

   1. Each of the three diesel generator rooms.

   2. Turbine lube oil tank room at Elevation 620'-0" of the turbine building.

   3. Turbine lube oil purifier room at Elevation 593'-0" of the turbine building.

   4. Unit 1 computer room subfloor at Elevation 638'-0" of the control complex.

   5. Unit 1 control room subfloors at Elevation 654'-0" of the control complex. The control room subfloor is isolated into three main subsections, each protected by its own CO2 system.

f. Local application carbon dioxide systems: Major components - low pressure CO2 tanks, master valve, selector valve, heat detectors, control panel, and discharge nozzles.

Two systems exist: one for each of the reactor recirculation pump motors.

g. Halon 1301 system: Major components – Halon tanks, valves, and distribution piping. All systems are actuated either by manual release stations or automatically (after a time delay) by the associated smoke detector system. For automatic operation, a pre-discharge alarm is provided to allow personnel evacuation time prior to release of Halon.

   Halon systems are used in the training center, in the TSC computer room, and in the service building telephone equipment room and metrology lab.

h. Manual Fixed Foam System: The system is manually actuated from a local control panel. Foam is piped directly to the auxiliary boiler fuel oil storage tank for surface application and to hose stations in the fuel oil unloading area.

i. Water standpipe and hose system: All areas of the plant are provided with manual firefighting capability in the form of fire service water supplied hose stations. They are primarily 75 feet of 1-1/2 inch minimum diameter hose on a hose reel and are equipped with a fog nozzle. Where necessary, variations such as hose cabinets or additional hose are provided.

j. Portable fire extinguishers: Portable fire extinguishers of the type and size appropriate to match the hazard involved have been located throughout the plant.

Fire suppression water is supplied by two 2,500 gpm fire pumps, one diesel driven and one motor-driven, each with the capability to meet the largest system demand. A looped distribution piping system is provided which is arranged and valved so that a single worst break in the distribution piping will not prohibit any fixed water system from getting the required flow at the required pressure.

Structural features of the fire protection system include adjoining plant buildings being separated by three-hour fire walls. Additionally, most plant buildings are further subdivided into fire areas which are separated by three-hour fire floors and walls. Openings in these three-hour separations are provided with rated doors and fire seals of the corresponding three hour rating.

System Boundary

System components subject to aging management review include various piping system components that are credited with fire suppression (both water and CO2), and fluid piping components that are located within structures that contain safety-related components, as shown on the LR boundary drawings.

Fire barriers are evaluated within the structural section and are not addressed here. Fire detection components are electrical rather than mechanical in nature.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP and EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Detect and suppress fires. [10 CFR 54.4(a)(3) – FP]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Provide alternate source of reactor pressure vessel injection.

Supply cooling water to the NCC heat exchangers during shutdown operation, when the service water system is out of service.

Component Types Subject to Aging Management Review

Table 2.3.3-24 lists the component types that require aging management review and their intended functions.

Table 3.3.2-24, Auxiliary Systems – Fire Protection System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-24
Fire Protection
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Flame arrestor	Pressure boundary
Flexible hose	Pressure boundary
Foam chamber (Discharge outlet)	Pressure boundary
Heat exchanger (Diesel fire pump HX channel)	Pressure boundary
Heat exchanger (Diesel fire pump HX shell)	Pressure boundary
Heat exchanger (Diesel fire pump HX tube)	Heat transfer, Pressure boundary
Muffler	Pressure boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary, Pressure boundary
Pump casing (Column)	Pressure boundary
Pump casing (Diesel fire pump fuel oil)	Pressure boundary
Pump casing (Diesel fire pump jacket water)	Pressure boundary
Pump casing (Suction bell)	Pressure boundary
Pump casing (Suction strainer element)	Filtration
Sight glass	Leakage boundary, Pressure boundary
Sight glass (Body)	Leakage boundary, Pressure boundary
Spray nozzle	Direct flow
Sprinkler head	Direct flow
Strainer body	Pressure boundary
Tank	Pressure boundary
Tank (CO2)	Pressure boundary
Tank (Fuel oil)	Pressure boundary
Tank (Pressure maintenance)	Leakage boundary

Component Type	Intended function
Tank (Retarding chamber)	Pressure boundary
Valve body	Leakage boundary, Pressure boundary
Valve body (Hydrant)	Pressure boundary

References

UFSAR: 9.5.1, Appendix 9A

License Renewal Drawings: 914-0001, 914-0002, 914-0003, 914-0004, 914-0005, 914-0010, 914-0013, 914-0016

2.3.3.25 Floor and Equipment Drains (P68)

System Description

The equipment and floor drainage system (EFDS) is designed to provide for collecting radioactive and potentially radioactive liquid wastes from floor drains and equipment drains throughout the plant and convey these wastes to building sumps located in the basemats of the major structures. In addition, the evaluation of roof drains is included within this report. Roof drains convey rainwater from various structures' roofs through piping to storm drains.

The EFDS consists of five separate, independent drain piping networks for segregating wastes into one of five categories as follows:

a. Floor drains (medium-to-low purity with medium conductivity).

b. Equipment drains (high purity with low conductivity).

c. Chemical drains (high conductivity).

d. Detergent drains.

e. Oil drains.

Separate building sumps from the liquid radwaste sump system are provided for the collection of each of these types of waste. Liquid waste disposal is accomplished via the liquid radwaste disposal system. Piping in the basemats is embedded in the concrete; piping is also embedded in the upper concrete floors where thickness of the floors permit. The EFDS is designed for gravity flow at atmospheric pressure with the piping sloped downward to the building sumps. In general, the tops of floor drains and floor sumps are located one and one-half inches below the nominal high point of the floor.

Traps are provided on floor drains to prevent the spread of an oil fire through the drain piping in areas where oil is contained in the equipment.

Floor Drains

Drains of medium to low purity and medium conductivity (normally low radioactivity), will be collected in the floor drainage system. These miscellaneous vents, unidentified leakage, certain equipment drains, and floor area drains discharge into floor drain sumps (dirty radwaste) located in the basemat of the drywell, containment, auxiliary building, heater bay, turbine power complex, intermediate building, and radwaste building. The fluid collected in these sumps will be discharged by sump pumps to the liquid radwaste disposal system for processing. Provisions are made for removal of oil from this sump water discharge before entering the liquid radwaste system.

The annulus is provided with a floor drain sump with no additional floor drains, since very little drain water is anticipated in this area.

The turbine power complex floor drain sump receives wastes from the turbine power complex, turbine building, offgas building, heater bay (Elevation 600'-6" and above), auxiliary boiler building, and the auxiliary building pipe chase at Elevation 565'-6".

The intermediate building floor drain sump receives wastes from the intermediate building, control complex ventilating equipment floor at Elevation 679'-6", certain areas of the control complex controlled access floor at Elevation 599'-0". Floor drains located in the control complex (Elevation 599'-0") which are sent to the intermediate building floor drain sump are the nuclear closed cooling heat exchanger and pump area, safety showers in laboratories, shop facility area, and the corridors.

Floor and equipment drains from Elevation 574'-10" and portions of Elevation 599'-0" and 620'-6" of the control complex will be included in the discussion of the detergent drains. The control complex floor drains for fire protection service at the control room floor Elevation 653'-6", and cable spreading area and battery room drains at Elevation 638'-6", discharge by gravity to the exterior yard catch basin system. Manual gate valves, normally closed, are provided for each of the four drains in the control room recessed concrete floor. These valves prevent the loss of carbon dioxide from the fire protection system for the power generation control center (PGCC) floor modules. The valves would be opened to drain fire water in case the fire hoses discharge into the control room.

In the auxiliary building, common mode flooding of the emergency core cooling system (ECCS) equipment rooms (i.e., flooding in one room which results in flooding of redundant ECCS equipment in adjacent rooms) is precluded by the design of the drainage piping. All drainage connections to equipment (flushing, relief valve discharge, seals, etc.) are hard piped to either a manifold, which connects directly into a sump external to the pump rooms, or to the drainage sumps within each pump room. Since no portion of the equipment drains or manifold is open to the atmosphere, it is not possible for flooding in one room to extend or communicate to an adjacent room by drainage lines. Also, discharge from the pump room drainage sump is controlled by a remote-manual actuator on the drainage line valve which is normally closed. This ensures that drainage of the sumps to the main auxiliary building sumps is completely controllable.

Open floor drains connect directly to the respective ECCS pump room sump. Discharge from the sump is actuated and controlled as noted above.

Redundant nonsafety grade level switches are installed in each drainage pit which will alarm in the control room on high water level in the pit. If leakage from a seal or gasket in the ECCS system is detected in one of the pump rooms during normal plant conditions, the remotely operated isolation valve installed in the pump's suction line would be closed, thereby preventing drawdown of the suppression pool below the minimum level (Elevation 589'-0"). The piping and manual isolation valves meet seismic criteria. The manually operated valve in the drain line for each ECCS pump room will prevent back flooding following a safe shutdown earthquake that would cause failure of non-seismic piping systems.

Each ECCS pump compartment is provided with watertight doors which are normally dogged closed and an indication is provided to the control room via the Plant Computer Alarm Display when the doors are opened.

Equipment Drains

Drains of high purity and low conductivity (normally high radioactivity) are collected in the equipment drainage system. These equipment drains and residual heat removal system flush drains discharge into an equipment drain sump (clean radwaste) located in the basemat of the drywell, containment, auxiliary building, turbine power complex, intermediate building, radwaste building, and control complex. The turbine power complex clean radwaste equipment sump also receives drains from the turbine building and the offgas building.

The turbine building ventilation system (TBVS) plenum drains produce non-contaminated condensate when they are in the cooling mode. The condensate is produced when outside air is passed over the cooling coils. The water produced by the condensation of outside air is uncontaminated and is routed to the storm drain system. The TBVS plenum drains also have a means of directing flow to the equipment drain sump. During the winter months when the plenums are being used to heat the buildings, the piping will be aligned to the equipment drains. Prior to switching the flow to the storm drain, the drainage water will be sampled to ensure that it is uncontaminated. The water from this drain will also be sampled in accordance with plant instructions during the time period that it is aligned to the storm drain system. The fluid collected in these sumps discharges by sump pumps to the Liquid Radwaste system for processing. Provisions are made for removal of oil from this sump water discharge before entering the liquid radwaste system.

Major items of equipment and the building sump into which they drain are as follows:

a. Containment building

   1. Fuel pool leak detection drain.
   2. Fuel pool overflow drain.
   3. RWCU heat exchangers drains.

4. RWCU holding pump seal drains.
5. RWCU containment sample drain.
6. Containment vessel air handling cooling water drain.
7. RWCU backwash transfer pump seal leakage.

b. Drywell
    1. Reactor recirculating system maintenance drains.
    2. Drywell cooling supply plenum cooling coil drain.
    3. Reactor vessel drain.
    4. Miscellaneous CRW drains.

c. Auxiliary building
    1. HPCS flush drain.
    2. RHR flush drain and RHR pump relief valve.
    3. LPCS flush drain.
    4. RWCU flush drain.
    5. RWCU pump drain.
    6. Turbine building water chiller and pump drain.
    7. NCC pump relief valve.
    8. RCIC pump relief valve.

d. Turbine power complex
    1. Offgas cooler condenser and inlet piping drain.
    2. Offgas loop seal drain.
    3. Condensate booster pump drain.
    4. Condensate heaters drain.
    5. Condensate filter holding pump drain.
    6. Condenser hogging pump drain.
    7. Sample extraction pump drain.

8. Feedwater seal injection pump drain.
9. Generator stator cooling unit drain.
10. Turbine building closed cooling heater exchanger and pump drain.
11. Condensate transfer pump drain.

e. Intermediate building

1. Drivewater filter and pump drains.
2. Cask storage pit drain.
3. Cask pit drain pump drain.
4. Fuel transfer tube drain tank and pump drain.
5. Circulating pump drain.
6. Fuel pool cooling and cleanup heat exchanger, post-filter and holding pump drains.
7. FPCC surge tank overflow.
8. NCC maintenance drain and relief valve.
9. Containment chiller pump drain.
10. Fuel pool F/D backwash transfer pump seal water.

f. Radwaste

1. RWCU sludge decant pump drain.
2. Condensate sludge decant pump drain.
3. Waste sample pump drain.
4. Fuel pool sludge decant pump drain.
5. Waste collector transfer pump drain.
6. WCT tank overflow.
7. WCTP drain.
8. WCT flush drain.
9. WST overflow.

g. Control complex

1. Service and instrument air receiver drains.
2. Service and instrument air compressor drains.
3. Emergency closed cooling heat exchanger shell drain.
4. Emergency closed cooling pump drain.
5. Control complex water chiller and pump drains.
6. Nuclear closed cooling heat exchanger shell drain.
7. Nuclear closed cooling pump drain.
8. Instrument air dryer drain.

Chemical Drains

A chemical waste sump is located in the basemat of the turbine power complex. Drains from the condensate demineralizer regeneration chemical waste tank and the waste transfer pump are collected in this sump. In the control complex, drains from the fume hoods and the laboratory sinks located in the high and low level laboratories, and the sink in the health physics and radiation protection service room are directed by gravity to the liquid radwaste system chemical waste tank located in the radwaste building.

Detergent Drains

A laundry and floor drain sump is located in the basemat of the control complex. Inputs to this sump consist of personnel decontamination solutions from the personnel decontamination room and the respiratory cleaning facility, floor drains from nonradioactive areas of the control complex and drains from the lake water side of the nuclear closed cooling system heat exchangers. The fluid collected in these sumps discharges by sump pumps to the liquid radwaste system detergent drains tanks. The detergent drain tank waste is processed via the radwaste flow drain system.

Oil Drains

A lube oil area floor and equipment drain sump is located in the east end of the turbine building basemat at Elevation 593’-6”. Equipment drains and floor drains for the turbine lube oil system and other hydraulic operated equipment located in this area are directed to this sump. In addition, floor and equipment drains are collected in this sump from the floor trench at fuel oil pumps in the auxiliary boiler building, from the feedwater turbine lube oil purifier room and turbine-driven feedwater pump rooms in the heater bay, and from the battery room in the turbine power complex.

Drainage collected in the turbine lube oil area and turbine laydown area sumps is normally pumped to the liquid radwaste system. There is also a piping interconnection to the industrial waste disposal system. To prevent inadvertent discharge to industrial waste, administrative procedures require the contents of both sumps to be sampled before transfer to industrial waste, and each line interconnecting these sumps with the industrial waste disposal system is isolated by a valve that is normally locked closed.

Floor and equipment drains from each of the three diesel generator rooms drain separately by gravity to the industrial waste disposal system. A trap is provided in the drain header discharging from each of the diesel generator rooms. Provisions are made for removal of oil from the diesel generator room drains in the industrial waste disposal system.

Roof Drains

Safety and nonsafety building roofs are drained by a combination of roof pitch, roof drains, parapet openings and scuppers. The drainage on the roofs is controlled to ensure that water depths developed during the LIP rainfall do not exceed the structural capacity of the roof. In case of complete blockage of roof downspouts on safety related buildings, building scuppers and parapet openings have been sized to ensure roofs will not exceed the maximum allowable loading limits.

System Boundary

System components subject to aging management review include valves and piping components within safety-related structures, as shown on the referenced LR boundary drawings. Unless otherwise noted on Scoping Drawings, this includes equipment drain funnels that appear on many drawings, equipment drain pans, and HVAC and air handling unit drains.

Pipe Plug (PY-2P68X0001) installed in a Unit 2 turbine power complex pipe tunnel sump is treated as a structural commodity preventing internal flooding from Unit 2 to Unit 1.

Some drain valves from the liquid radwaste sumps system (G61), as shown on license renewal boundary drawings 911-0617 and 911-0628, are evaluated within this system.

Roof drain piping is also evaluated within this system but is not depicted on LR boundary drawings.

Building roof scuppers and parapets are evaluated as part of structural commodities.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Prevent flooding of the ECCS rooms by backflow through the floor drains. [10 CFR 54.4(a)(2)]

Auxiliary Building floor drains on the 599' and 620' elevation mitigate internal flooding. [10 CFR 54.4(a)(2)]

During a Local Intense Precipitation event the roof drains are credited to prevent failures of nonsafety building roofs and resultant internal flooding. [10 CFR 54.4(a)(2)]

Diesel generator floor drain traps prevent the spread of an oil fire through the drain piping. [10 CFR 54.4(a)(3) – FP]

Collect radioactive and potentially radioactive liquid wastes from floor drains and equipment drains throughout the plant.

Component Types Subject to Aging Management Review

Table 2.3.3-25 lists the component types that require aging management review and their intended functions.

Table 3.3.2-25, Auxiliary Systems – Floor and Equipment Drains System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-25
Floor and Equipment Drains
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Drain pan	Leakage boundary
Drains	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Strainer body	Pressure boundary
Strainer Element	Filtration
Tank (Drain receiver)	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 2.4.2.3, 9.3.3.1, 9.3.3.2.1, 9.3.3.2.2, 9.3.3.2.3, 9.3.3.2.4, 9.3.3.2.5, Appendix 9A 9A.4.5.1. Letter L-22-272, Attachment 2, proposed text UFSAR 2.4.2.3

License Renewal Drawings: 911-0021, 911-0022, 911-0023, 911-0601, 911-0617, 911-0627, 911-0628, 911-0629, 911-0671, 911-0691, 912-0604, 919-0022

2.3.3.26 Fuel Handling Area Ventilation (M40)

System Description

The Fuel Handling Area Ventilation (FHAVS) provides heating and ventilation for the various operating areas of the fuel handling area and ventilating equipment areas, and provides effective protection for personnel against airborne radioactive contaminants.

The supply subsystem (FHASS) continuously draws outside air through roughing filters and heating coils. One of the two 100 percent capacity supply fans normally operates to draw air through the supply plenum and discharge it to the supply ductwork for distribution. The areas provided with supply air are the control rod drive pump areas, the FHAVS equipment area, the railway and overhead crane area, and the periphery of the fuel pool area on all sides. The general air flow pattern in the fuel handling area is from areas of low probable airborne contamination to areas of high probable airborne contamination. The ventilation pattern in the fuel pool areas is from the supply around the periphery of the pools toward the exhaust located directly above the pools.

The exhaust subsystem (FHAES) continuously draws air from the CRD pump areas, the control rod drive maintenance area, the area above the fuel pools, and from the fuel pool cooling, cleaning and post-accident sampling system (PASS) equipment rooms located in the intermediate building. Two of the three 50 percent charcoal exhaust units are operating normally to draw air through the exhaust ductwork and discharge it to the atmosphere through the unit vent.

In the event that the radiation monitors located upstream of the charcoal exhaust units senses high radiation, the high radiation signal alarms in the control room and automatically trips the supply fan. The exhaust system remains operational to continue exhausting contaminated air from the fuel handling area through charcoal filters, thus precluding any uncontrolled release of radioactivity to the outside. Two barometric pressure relief dampers in the supply duct would relieve any excessive negative building pressure.

The FHASS and FHAES are classified as Safety Class 3, Seismic Category I.

The exhaust subsystem of fuel handling area ventilation system known as the fuel handling area exhaust subsystem (FHAES), is an engineered safety feature (ESF) filter system that reduces the concentration of airborne radioactive contaminants following a design basis accident. The remote possibility of release of airborne radioactive contaminants due to a fuel handling accident, the requirements of 10 CFR 50, Appendix A, General Design Criterion (GDC) 61, and the recommendations of Regulatory Guide 1.13 establish the need for FHAES to accomplish fuel pool area air filtration. GDC 61 requires, in part, that fuel storage and handling, and radioactive waste and other systems that may contain radioactivity be designed to ensure adequate safety under normal and postulated accident conditions and that appropriate filtering systems be provided. However, no accident dose calculations credit the FHAES as described in UFSAR sections 15.7.4 and 15.7.6.

System Boundary

System components subject to aging management review are safety-related filter plenums, fans, duct, dampers, and nonsafety-related drain plenum drain piping and valves.

Fire water and heating water components (including heating coils within filter plenum) are evaluated within fire protection and building heating systems (P54 and P55, respectively).

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, because it is relied on to perform a function that demonstrates compliance with the regulations for FP and for EQ.

Fuel Handling Area Ventilation is designed to remove and process the radiation release resulting from a fuel cladding failure accident event in the fuel handling area. [10 CFR 54.4(a)(1)]

Prevent excessive negative pressure in the fuel handling building. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

System fire dampers prevent the spread of fire. [10 CFR 54.4(a)(3) – FP]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Maintain the temperature of the fuel handling areas, and any other areas they serve, within a range suitable for operating personnel and equipment.

Component Types Subject to Aging Management Review

Table 2.3.3-26 lists the component types that require aging management review and their intended functions.

Table 3.3.2-26, Auxiliary Systems – Fuel Handling Area Ventilation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-26
Fuel Handling Area Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Filtration
Filter plenum	Pressure boundary
Flexible connection	Pressure boundary
Flow element	Pressure boundary
Piping	Pressure boundary, Leakage boundary
Valve body	Pressure boundary

References

UFSAR: 6.5.1, 9.4.2.1, 9.4.2.2

License Renewal Drawings: 912-0617

2.3.3.27 Fuel Storage (F16) and Fuel Pool Cooling and Cleanup (G41)

System Description

The fuel pool cooling and cleanup (FPCC) system removes decay heat from the spent fuel stored in the fuel pool and maintains water temperature, purity, clarity, and level. In the event of an abnormal heat load such as a full core offload, the RHR system can be used to supplement the normal cooling system while in cold shutdown or refueling mode. The fuel storage system provides new fuel racks, spent fuel racks, multi-purpose storage cavities and neutron absorbers.

The FPCC system cools the spent fuel storage pools by transferring the spent fuel decay heat to the nuclear closed cooling system during normal plant operation. The FPCC system consists of two parallel pumps and two parallel heat exchangers. Water from the upper and lower pools is transferred to the surge tanks in the fuel handling building. Overflow from the tanks is channeled to the radwaste system. The circulating pumps take suction from the bottom of the tanks and pump the water through the components of the system.

Clarity and purity of the pool water are maintained by a combination of filtration and demineralization. The cleanup system consists of two sets of filter demineralizers, each of which has its own piping and is capable of independent operation. Because the filter demineralizers are of the pressure precoat type, the system depends on flow to keep the filter medium on the filter elements. Each filter demineralizer uses a holding pump to automatically maintain flow across the filter in case loss of flow from the main system occurs.

New fuel storage racks are located in the new fuel storage vault and are designed to store fuel assemblies in an array which is sufficient to maintain K_{eff} of 0.95 or less in the normal dry condition or abnormal completely water flooded condition. New fuel may not be stored in the new fuel storage vaults until such time a criticality analysis is completed. PNPP procedures prohibit the storage of new fuel in the new fuel storage vaults.

Two kinds of spent fuel storage racks are used: those achieving subcriticality by spacing in a loose packed geometric array, and those using a neutron absorber to achieve subcriticality in a close packed or dense geometric array. The loose packed fuel storage racks are used in containment. The densified fuel storage racks are used in the spent fuel storage pits in the fuel handling and storage area of the intermediate building (also called the fuel handling building). Multi-purpose storage cavities that can hold defective fuel, guide tubes or control rods are also provided.

System Boundary

System components subject to aging management review include pumps, valves, heat exchangers, filter-demineralizers, and other piping components connected to the fuel pools, cask pit, reactor well and separator storage well, as depicted on LR boundary drawings. Spent fuel racks and neutron absorbers are also subject to aging management.

The leak detection cone strainer, which appears on drawing 302-0651, are evaluated with this system.

The pool liners, skimmers, and scuppers are evaluated as structural commodities.

The Cask Pit Pool Waste Storage Rack 1F16E0012, which provides a compact storage location for control rod blades, is evaluated as a structural commodity.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ and SBO.

Remove decay heat from the spent fuel stored in the fuel pool and reactor (during refueling) [10 CFR 54.4(a)(1)]

Spent fuel racks protect the fuel assemblies from physical damage. [10 CFR 54.4(a)(1)]

Spent fuel racks maintain stored fuel subcritical by at least 5 percent delta-K. [(a)(1)]

Maintain pool water level and reactor water level (during refueling) [10 CFR 54.4(a)(1)]

Minimize release of radioactive elements to the environment [10 CFR 54.4(a)(1)]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1), (a)(3) - SBO]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [(a)(3) – EQ]

New fuel racks protect new fuel assemblies from physical damage.

Component Types Subject to Aging Management Review

Table 2.3.3-27 lists the component types that require aging management review and their intended functions.

Table 3.3.2-27, Auxiliary Systems – Fuel Storage and Fuel Pool Cooling and Cleanup System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-27
Fuel Storage and Fuel Pool Cooling and Cleanup
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary, Structural integrity, Structural support
Drain pan	Leakage boundary
Filter housing	Leakage boundary
Filter-demin housing	Leakage boundary
Flexible hose	Pressure boundary, Leakage boundary
Flow element	Leakage boundary
Fuel storage rack (Defective fuel)	Structural support
Fuel storage rack (Spent fuel)	Structural support
Heat exchanger (Channel)	Pressure boundary

Component Type	Intended function
Heat exchanger (Channel cover)	Pressure boundary
Heat exchanger (Shell)	Pressure boundary
Heat exchanger (Tube)	Heat transfer, Pressure boundary
Heat exchanger (Tubesheet)	Pressure boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary, Structural integrity
Neutron absorber	Absorb neutrons
Piping	Leakage boundary, Pressure boundary, Structural integrity
Pump casing	Leakage boundary, Pressure boundary
Sight glass	Leakage boundary
Sight glass (Body)	Leakage boundary
Strainer body	Leakage boundary
Tank	Leakage boundary, Pressure boundary
Valve body	Leakage boundary, Pressure boundary, Structural integrity

References

UFSAR: 1.2.2.8.3, 9.1.1, 9.1.2, 9.1.3, Appendix 15H.2

License Renewal Drawings: 302-0651, 302-0653, 302-0654, 302-0655

2.3.3.28 Hydrogen Water Chemistry (P73)

System Description

The hydrogen water chemistry (HWC) system injects hydrogen into the feedwater system. The hydrogen combines with oxygen and oxides in the reactor water, lowering the Electrochemical Corrosion Potential (ECP) to below the −230mV Standard Hydrogen Electrode threshold to mitigate the potential and growth of Intergranular Stress Corrosion Cracking (IGSCC) of stainless steel piping and reactor internal components. Due to the recombination of free hydrogen and oxygen, this injection results in a substantial reduction of oxygen levels, thereby reducing a critical contributor to IGSCC. The hydrogen injection into the feedwater system results in an offgas mixture exiting the condenser that contains excess hydrogen. To prevent discharging this mixture and creating a potential fire or explosion hazard, a stoichiometric amount of oxygen is added upstream of the recombiner to recombine the hydrogen in the offgas system.

The hydrogen water chemistry system consists of a storage subsystem, a supply subsystem, an injection subsystem, and an On-Line NobleChem Monitoring system (OLNC). Liquid Hydrogen (H2) and Oxygen (O2) are cryogenically stored. The liquid hydrogen is pumped into supplemental gaseous storage tanks. The liquid hydrogen and oxygen are cryogenically stored in separate storage facilities remote from the nearest safety-related structure and air intakes into safety-related structures. This separation distance ensures that a potential hydrogen fire or explosion will not cause failure of any safety-related structures. The supply subsystem includes the hydrogen and oxygen pipelines and instrumentation lines between the storage facility and the turbine building. The hydrogen and oxygen are delivered to the Unit 1 turbine building and heater bay building by two 2-inch diameter pipes (one for each commodity). The supply subsystem piping is not routed inside or attached to the outside of safety-related structures. The injection subsystem consists of hydrogen and oxygen injection modules, control stations, and associated interfaces required to monitor and control the injection of hydrogen and oxygen. The HWC System includes a cross-tie connection to the generator hydrogen supply system to provide an alternate hydrogen supply to the main generator from the HWC storage facility.

The hydrogen water chemistry system is nonsafety-related and is not required for safe shutdown of the reactor. The hydrogen injection system is located in a portion of the heater bay (hydrogen injection) and turbine building (oxygen injection) remote from safety-related equipment. In the event an accident occurs, there is no interaction between the HWC injection system and other plant components which may need to perform a safety-related function.

The On-Line NobleChem (OLNC) system is a nonsafety-related sub-system to the HWC system. The OLNC system is comprised of an injection system and a Mitigation Monitoring System (MMS). The injection portion injects a noble metal compound into the reactor feedwater system during plant operation, to produce catalytic deposits on the reactor internal surfaces. The OLNC injection portion can also inject into the reactor water cleanup (RWCU) system when the Feedwater injection point is not available. The MMS analyzes the amount of noble metal remaining on the monitor’s sample coupons, which is representative of the amount of noble metal remaining on the internal surfaces of the reactor vessel.

System Boundary

System components subject to aging management review include nonsafety-related flow elements, valves and piping components within safety-related structures, as shown on the referenced LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Inject hydrogen into Feedwater to control oxygen content.

Inject oxygen upstream of offgas recombiner to control offgas hydrogen content.

Monitor coolant chemical control.

Component Types Subject to Aging Management Review

Table 2.3.3-28 lists the component types that require aging management review and their intended functions.

Table 3.3.2-28, Auxiliary Systems – Hydrogen Water Chemistry System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-28
Hydrogen Water Chemistry
Component Types Subject to Aging Management Review

Component Type	Intended function
Flow element	Leakage boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.3.8.1, 9.3.8.2, 9.3.8.3

License Renewal Drawings: 302-0078

2.3.3.29 Inclined Fuel Transfer System (F42)

System Description

The inclined fuel transfer system is used to transfer fuel, control rods, defective fuel storage containers, and other small items between the containment and the fuel building pools by means of a carriage traveling in a transfer tube (a 23-inch I.D. stainless steel pipe). At the containment upper pool, the transfer tube connects to pool penetration and to a sheave box. Connected to the sheave box is a 24-inch flap valve, a vent pipe, cable enclosures, and a fill valve. In the fuel building pool, the transfer tube connects to a 24-inch gate valve. A bellows connects the fuel building penetration to the valve and transfer tube to prevent water entrapment between the tube and penetration.

A four-inch weld-o-let located on the transfer tube approximately two feet above the fuel building pool water level and a motor-operated valve are provided for connections to a drainpipe for water level control in the transfer tube. A containment isolation assembly containing a blind flange and a bellows which connects from the containment penetration to the assembly are provided to make containment isolation.

A hydraulic power unit with attendant piping and valves is provided in the fuel handling building and the reactor building to actuate the cylinders attached to the upenders, the fill valve, the flap valve, and the fuel building gate valve.

Containment is made by the containment isolation assembly and blind flange, containment bellows and the steel containment penetration. Special gaskets and double ply bellows are provided for leak checking to ensure containment isolation. A bellows assembly with a test connection is installed to permit confirmatory leak testing of the double ply bellows. When the blind flange is removed in operating Modes 1, 2, or 3, containment is made by the remaining portion of the containment isolation assembly, containment bellows, steel containment penetration, transfer tube, drain line, drain valve, and local leak rate test valve. A time restriction of 60 days per cycle exists for this configuration, i.e., the blind flange removed in operating Modes 1, 2, or 3.

The Unit 1 inclined fuel transfer system provides a pressure boundary for maintaining water inventory in the safety-related containment upper pools.

The Unit 2 transfer tube, bellows and associated piping components are retired in place but portions still provide a leakage boundary function.

System Boundary

System components subject to aging management review include the inclined fuel transfer tube and associated valves and equipment, the hydraulic components that provide motive force for the lower transfer tube valve, and the refueling bellows, as shown on LR boundary drawings. The Unit 2 inclined fuel transfer tube and associated components as shown on LR boundary drawing 302-0970 are also subject to aging management review.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Provide containment integrity. [10 CFR 54.4(a)(1), (a)(2)]

Provide a pressure boundary for maintaining water inventory in the containment upper pools. [10 CFR 54.4(a)(1), (a)(2)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Support movement of fuel and other components between containment and the fuel building.

Component Types Subject to Aging Management Review

Table 2.3.3-29 lists the component types that require aging management review and their intended functions.

Table 3.3.2-29, Auxiliary Systems – Inclined Fuel Transfer System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-29
Inclined Fuel Transfer System
Component Types Subject to Aging Management Review

Component Type	Intended function
Accumulator	Leakage boundary
Bellows (Transfer tube)	Pressure boundary
Bolting	Pressure boundary, Leakage boundary
Filter housing	Leakage boundary
Fuel transfer tube	Pressure boundary, Leakage boundary, Structural Support
Piping	Pressure boundary, Leakage boundary, Structural Support
Pump casing	Leakage boundary
Sight glass	Leakage boundary
Sight glass (Body) Tank (Sump)	Leakage boundary Leakage boundary
Valve body	Pressure boundary, Leakage boundary, Structural Support

References

UFSAR: 9.1.4.2.3.11

License Renewal Drawings: 302-0970, 302-0972, 302-0973

2.3.3.30 Industrial Waste Disposal (P64)

System Description

The industrial waste disposal system contains oil interceptors to process drains from transformer basins. The separated water is directed to catch basins. A sludge holding sump receives blowdown from the makeup water pretreatment system, as well as the discharge from an oil separator that processes plant drains. The plant oily drains collected in the turbine lube oil area and turbine laydown area sumps are normally pumped (remote manual initiation) to the liquid radwaste system but may be directed to the industrial waste disposal system.

Floor and equipment drains from the diesel generator building drain separately by gravity to an oil interceptor tank buried in the yard. That oil interceptor tank connects to the sludge holding sump in the industrial waste disposal system. A trap is provided in the drain header discharging from each of the diesel generator rooms.

A waste lagoon receives non radiological chemical cleaning and flushing wastes, and can be decanted to the makeup water pretreatment system to allow the settled sludge to be removed by truck.

The system is entirely nonsafety-related and is located in the plant yard and yard structures.

System Boundary

The oil interceptor tank vent lines and the sludge holding sump flapper valve are subject to aging management review.

The oil interceptor tank and manway cover are scoped as structural commodities.

System Functions (and scoping criteria, if intended function)

The system contains mechanical components that are nonsafety-related whose failure could result in failure of a safety-related function. The system does not contain any mechanical components that are safety-related or that are credited for regulated events.

Receive and process oily drains and industrial wastes.

The oil interceptor tank vent line openings are located above the water surface elevation for a probable maximum precipitation (PMP) event, and along with the tank manway cover combine to preclude flooding of the oil interceptor tank and the diesel generator building. [10 CFR 54.4(a)(2)]

The sludge holding sump flapper valve (0P64F-0511) provides a boundary to the oil interceptor tank to prevent high sump levels from flooding the oil interceptor tank and the diesel generator building. [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

Table 2.3.3-30 lists the component types that require aging management review and their intended functions.

Table 3.3.2-30, Auxiliary Systems – Industrial Waste Disposal System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-30
Industrial Waste Disposal
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Piping	Pressure boundary
Valve body	Pressure boundary

References

UFSAR: 9.3.3.2.5

License Renewal Drawings: 302-0371

2.3.3.31 Intermediate Building Ventilation (M33)

System Description

The intermediate building ventilation supply unit continuously draws outside air through roughing filters (the supply roughing filters may be removed to preclude snow buildup on the filters) and heating coils and supplies it to the general areas of the building. This supply air is drawn through the various ventilation equipment rooms and is then discharged to the atmosphere by the unit vent. The supply air drawn through the fuel pool cooling and cleanup system equipment rooms and the post-accident sampling room is directed through the charcoal filter train of the fuel handling area exhaust system before being discharged to the atmosphere by the unit vent. The supply air drawn through the Intermediate Building tool storage/tool decontamination areas is directed through the sub-exhaust unit, which contains a filter train consisting of roughing filters, HEPA pre-filters, charcoal filters and HEPA after-filters. After passing through the filter train, the exhaust air from these areas is carried through the system exhaust ductwork and is exhausted to the atmosphere through the unit vent. During periods of emergency, as may result from a LOCA or loss of offsite power, this system is not required to operate.

This system is nonsafety-related and non-seismic classified, except for the sub-exhaust charcoal filter plenum which is designed to satisfy the requirements of Seismic Category I items.

The intermediate building ventilation Unit 1 and 2 plant vent flow elements (straighteners) are safety-related and indications from them are used together with the Unit 1 & 2 plant vent radiation monitors to establish a release rate.

Select ductwork, access doors and duct external strapping provide an HVAC-related tornado depressurization barrier.

System Boundary

System components subject to aging management review include fire dampers and duct, filter plenum, and plenum drain piping and valve as shown on the LR boundary drawing.

Fire protection and hot water heating fluid components are evaluated with the P54 fire protection and P55 building heating systems.

The intermediate building ventilation safety-related Unit 1 and 2 plant vent flow elements are evaluated as part of the D17 & D19 (plant radiation monitoring and process monitoring, and post-accident radiation monitoring) systems.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Selected nonsafety system ducting required to support control building pressure transient during a tornado. [10 CFR 54.4(a)(2)]

System fire dampers prevent the spread of fires. [10 CFR 54.4(a)(3) – FP]

Provide adequate ventilation in the intermediate building.

Component Types Subject to Aging Management Review

Table 2.3.3-31 lists the component types that require aging management review and their intended functions.

Table 3.3.2-31, Intermediate Building Ventilation – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-31
Intermediate Building Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Filter plenum	Leakage boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.4.7.1, 9.4.7.2

License Renewal Drawings: 912-0613

2.3.3.32 Leak Detection (E31)

System Description

The nuclear leak detection and monitoring system consists of temperature, pressure, flow, and fission product sensors with associated instrumentation and alarms. This system detects, annunciates and in some cases isolates leakage in the following systems:

a. Main steam lines

b. Reactor water cleanup (RWCU) system

c. Residual heat removal (RHR) system

d. Reactor core isolation cooling (RCIC) system

e. Feedwater system

f. ECCS systems

g. Miscellaneous systems

Small leaks generally are detected by monitoring the air coolers condensate flow, radiation levels and drain sump fill-up and pump-out rates. Large leaks are also detected by changes in reactor water level and changes in flow rates in process lines.

System Boundary

System components subject to aging management review include piping components, valves, and instrumentation associated with leakage from the above systems, as shown on LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

System piping penetrating the drywell provide a drywell pressure boundary function. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Safety-related instrumentation detects, annunciates and in some cases creates isolation signals on indications of system leakage. [10 CFR 54.4(a)(1), (a)(3) - EQ]

Component Types Subject to Aging Management Review

Table 2.3.3-32 lists the component types that require aging management review and their intended functions.

Table 3.3.2-32, Auxiliary Systems – Leak Detection System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-32
Leak Detection
Component Types Subject to Aging Management Review

Component Type	**Intended function**
Bolting	Leakage boundary, Pressure boundary
Flexible hose	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Sight glass	Leakage boundary
Sight glass (Body)	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 1.2.2.3.6, 7.6.1.3

License Renewal Drawings: 302-0961, 302-0962, 302-0964

2.3.3.33 Liquid Radwaste Disposal (G50)

System Description

The system collects, monitors, treats, stores, and recycles or releases radioactive liquid wastes. These wastes are collected in sumps and drain tanks at various locations throughout the plant and then transferred to collection tanks in the radwaste facility for treatment, storage and recycle or release.

Wastes are processed on a batch basis with each batch being processed by methods appropriate for the quality and quantity of materials present. Most of the processed liquid is returned to the condensate system.

Incoming streams of liquid waste are collected and treated in one of four separate process streams according to their composition. These four subdivisions are high purity/low conductivity wastes (primarily equipment drains), medium-to-low purity/medium conductivity wastes (primarily floor drains), high conductivity chemical wastes, and detergent drains.

In addition to handling these four categories of liquid waste, the liquid radwaste (LRW) system collects spent resin slurries and filter backwash slurries prior to being sent to the solid radwaste (SRW) disposal system.

It is postulated that an unspecified event causes a failure of a tank in the radwaste building in order to assess the consequences of a liquid containing tank failure.

System Boundary

System components subject to aging management review include the fuel pool filter--demin backwash receiving tank, pumps, valves and piping components within the auxiliary, control, intermediate, and reactor buildings, as depicted on the LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ and SBO.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1), (a)(3)-SBO]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

For the liquid containing tank failure event, it is conservatively assumed that 80 percent of the design capacity is immediately released from the building, i.e., no credit is taken for retention of any of the released liquids in the Seismic Category I radwaste building.

Component Types Subject to Aging Management Review

Table 2.3.3-33 lists the component types that require aging management review and their intended functions.

Table 3.3.2-33, Auxiliary Systems – Liquid Radwaste Disposal System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-33
Liquid Radwaste Disposal
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 1.2.2.9.2, 11.2; 15.7.2, 15.7.3, Appendix 15H.2

License Renewal Drawings: 302-0731, 302-0733, 302-0734, 302-0736, 302-0737, 302-0738

2.3.3.34 Liquid Radwaste Sumps (G61)

System Description

The liquid radwaste sumps system receives input from floor and equipment drains, chemical waste drains, and laundry drains (system P68). The turbine lube oil area floor drain sump discharge to the plant industrial waste system (P64). The chemical waste drain sumps and laundry drains sumps discharge directly to the liquid radwaste system (G50), while other equipment and floor drains sumps discharge to the liquid radwaste system via oil separators.

System Boundary

System components subject to aging management review include pumps, valves, orifices and piping components associated with sump discharge piping within safety-related structures, as shown on the referenced LR boundary drawings.

The portions of nonsafety-related sump pumps that are submerged in sumps cannot cause spatial interactions with nearby safety-related equipment (i.e., by leaking or spraying below the waterline). The design of some sump pumps has a casing that extends above the waterline to the discharge piping connection. In another design, the pump casing is completely submerged, with a discharge riser pipe connecting to the casing under water. Only the portions of the pumps, discharge piping and bolting above the waterline are within scope. In addition, portions of nonsafety-related cooling coils that are submerged in sumps cannot cause spatial interactions with nearby safety-related equipment (i.e., by leaking or spraying below the waterline). Only the portions of the piping above the waterline are within scope.

The aux building sump discharge valves shown on license renewal boundary drawing 911-0617 and the new fuel storage pool drain valves shown on license renewal boundary drawing 911-0628 are evaluated in the floor and equipment drain (P68) system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ and SBO.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1), (a)(3) - SBO]

Provide indication/alarm of high water level that could be an indication of system leakage. [10 CFR 54.4(a)(2)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Collect liquid drains and transport the liquids for disposal.

Component Types Subject to Aging Management Review

Table 2.3.3-34 lists the component types that require aging management review and their intended functions.

Table 3.3.2-34, Auxiliary Systems – Liquid Radwaste Sumps – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-34
Liquid Radwaste Sumps
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Orifice	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 9.3.3.1, 11.2.2.10.k, Appendix 15H.2

License Renewal Drawings: 302-0739, 302-0740, 302-0741

2.3.3.35 MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust (M23 & M24)

System Description

The MCC, switchgear and miscellaneous electric equipment areas HVAC system operates continuously to provide cooling or heating during normal plant operation, during plant shutdown and following loss of offsite power or a LOCA. The areas served by this system include MCC, switchgear, dc switchgear rooms, battery rooms, HPCS switchgear rooms, reactor protection system rooms, remote panel shutdown rooms, cable spreading areas, and HVAC equipment rooms. The HVAC system consists of two 100 percent capacity supply plenums that house roughing filters and chilled water-cooling coils, two 100 percent capacity supply fans, a supply duct system with electric reheat coils, and a return duct system.

The duct systems and controls are arranged so that a mixture of outside air and return air from the HVAC equipment room is directed through the cooling plenum and supplied to the various areas requiring cooling or heating. Room air, from all areas except the battery rooms, after satisfying the cooling or heating function, is directed to the return fan and delivered to the HVAC equipment room.

The battery room exhaust system operates continuously during normal plant operation, during plant shutdown and following loss of offsite power or a LOCA to exhaust the battery rooms to the outside. In the event of an emergency, the exhaust may be remote-manually redirected to a recirculation mode. In this mode, the exhaust air from the battery rooms is directed to the supply plenum of the MCC, Switchgear and Miscellaneous Area HVAC fans.

The MCC, switchgear, & misc area HVAC and battery room exhaust systems, excluding the electric reheat coils, is classified as Safety Class 3, Seismic Category I. The electric reheat coils are classified as nonsafety-related and non-seismic category.

System Boundary

System components subject to aging management include fans, dampers, and associated ducting components as depicted on the LR boundary drawing.

Cooling water components associated with the supply plenums are evaluated in the control complex chilled water (P47) system.

Structural missile barriers provided on the relief air ducts to prevent external missiles from entering the control complex are evaluated as structural.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

Remove heat generated in the dc switchgear rooms, HPCS switchgear rooms, reactor protection rooms, cable spreading areas, and HVAC equipment rooms. [10 CFR 54.4(a)(1), (a)(3) – FP]

Prevent the accumulation of combustible gas in the battery rooms. [10 CFR 54.4(a)(1), (a)(3) – FP]

Provide smoke exhaust capability for the cable spreading, MCC and switchgear rooms, and the control complex chase. [10 CFR 54.4(a)(3) – FP]

Component Types Subject to Aging Management Review

Table 2.3.3-35 lists the component types that require aging management review and their intended functions.

Table 3.3.2-35, Auxiliary Systems – MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-35
MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Flexible connection	Pressure boundary
Flow element	Pressure boundary
Heater housing	Pressure boundary
Plenum	Pressure boundary

References

UFSAR: 9.4.1.1.1, 9.4.1.1.2, 9.4.1.2.1, 9.4.1.2.2, Appendix 9A.3.2, Table 9A.3-1, Appendix 15H.2.2

License Renewal Drawings: 912-0609

2.3.3.36 Miscellaneous Area Ventilation (M46)

System Description

The miscellaneous area HVAC system consists of the following nonsafety-related subsystems:

- Turbine lube oil storage area ventilation
- Service water pumphouse ventilation
- Diesel driven fire pump area ventilation

- Auxiliary boiler building ventilation
- Inservice inspection equipment room ventilation
- Sanitary waste treatment control house ventilation
- Discharge tunnel dechlorination equipment building ventilation
- Fuel oil pumphouse ventilation
- Cement storage area ventilation
- Fire service & construction water pump house ventilation
- Decant control structure heater
- Various elevator equipment rooms ventilation
- Spent fuel dry storage electrical building ventilation
- Health Physics control point and office area ventilation

The only subsystems which include components that require aging management review are the turbine lube oil storage area ventilation system, the diesel driven fire pump area ventilation system, and the HP control point ventilation system, each of which contain fire dampers that provide a three-hour rated barrier. The diesel driven fire pump area ventilation subsystem also supports operation of the diesel driven fire pump.

The Turbine Lube Oil Storage area ventilation system functions during normal plant operation. It provides heating and ventilation in the turbine lube oil storage areas. During summer operation, ventilation of the lube oil areas is accomplished by drawing outside air through a supply fan and discharging the air to various storage areas. This supply air is relieved to the atmosphere through wall louvers. Operation of the supply fans is initiated from a local control switch. During winter operation, a portion of the ambient air is recirculated depending upon the outdoor temperature.

Also, hot water unit heaters with remote thermostats are provided to maintain suitable minimum ambient temperature.

The diesel driven fire pump area ventilation system provides ventilation in the diesel driven fire pump area to maintain suitable environment for equipment operation. Ventilation of the diesel driven fire pump area is accomplished by supply fans that draw ambient air from the emergency service water pumphouse and discharge it to the fire pump area. This supply air is then relieved to the atmosphere through a ducted relief louver. Operation of the supply fans is initiated whenever the diesel driven fire pump starts. The fans may also be manually started from the local selector switches. High temperature switches in the supply fan discharge ducts and the exhaust duct automatically stop the supply fans on indication of high temperature.

The health physics access control point and office facility HVAC System consists of three air handling units and one exhaust fan. The AHUs consist of a cooling coil, roughing filter, and fan in one single unit. All AHU components are located above the ceiling at the HP access control facility which is located in the 620 elevation of the control complex building. The exhaust fan takes a suction on the RCA access corridor within the service building and discharges this air to the M54 SB hot shop HVAC system. The exhaust fan is located in the SB hot machine shop. A fire damper associated with this exhaust fan provides a fire barrier between fire zone IB-3 and the service building.

System Boundary

System components subject to aging management review include fire dampers, ductwork, bolting, and fan housings as shown on the LR boundary drawings. This includes the PY-0M46 duct test specimens located in the IB-585 pipe chase that are tested each refuel outage for indication of age-related degradation of silicon sealant used in ESF ventilation system ductwork per Commitment L01090.

Heating and cooling water components are evaluated in the P55 building heating system and P50 containment vessel chilled water system respectively. Motor operated wall louvers associated with the system are evaluated in the L53 motor operated louvers system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

System fire dampers prevent the spread of fires. [10 CFR 54.4(a)(3) – FP]

Miscellaneous HVAC Diesel Driven Fire Pump Area Fans provide air to the diesel-driven fire pump area during fire pump operation. [10 CFR 54.4(a)(3) – FP]

Maintain a suitable environment for equipment operation.

Component Types Subject to Aging Management Review

Table 2.3.3-36 lists the component types that require aging management review and their intended functions.

Table 3.3.2-36, Auxiliary Systems – Miscellaneous Area Ventilation – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-36
Miscellaneous Area Ventilation
Component Types Subject to Aging Management Review

Component Type	**Intended function**
Bolting	Pressure boundary

Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary

References

UFSAR: 9.4.12.2.3, 9.4.12.2.4, 9.4.12.2.5, 9.4.12.2.6, Appendix 9A.4.3.3, Appendix 9A4.6.2, Appendix 9A4.16

License Renewal Drawings: 912-0629, 912-0632

2.3.3.37 Miscellaneous Electrical Areas Smoke Ventilation (M49)

System Description

With the exception of the tornado dampers and associated ducting, the miscellaneous electrical areas smoke venting system is nonsafety and functions only when a high smoke condition occurs in the electrical areas such as the motor control center and switchgear rooms, cable spreading areas, duct and cable chases, and the cable tunnels. The smoke venting system will clear the smoke and enhance visibility to aid fire fighters in the affected areas.

Smoke venting is accomplished by exhausting air from the affected electrical areas through an axial flow fan and discharging the exhaust air to the atmosphere through the unit vent. Operation of the smoke venting fans is initiated manually from the intermediate building upon receipt of high smoke alarm from any of the electrical areas served.

Two axial fans are provided, and each electrical power division is served independently by a separate exhaust fan.

System Boundary

System components subject to aging management review include fan housings, dampers, and duct components as shown on the LR boundary drawing.

Unit 2 miscellaneous electrical areas smoke ventilation (M49) fire dampers and tornado depressurization duct blank-off plates are evaluated as structural.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

System tornado dampers control building pressure transient during a tornado. [10 CFR 54.4(a)(1)]

Selected nonsafety system ducting required to support control building pressure transient during a tornado. [10 CFR 54.4(a)(2)]

Clear smoke and enhance visibility to aid fire fighters in the affected areas. [10 CFR 54.4(a)(3) – FP]

Fire dampers prevent the spread of fire. [10 CFR 54.4(a)(3) – FP]

Component Types Subject to Aging Management Review

Table 2.3.3-37 lists the component types that require aging management review and their intended functions.

Table 3.3.2-37, Auxiliary Systems – Miscellaneous Electrical Areas Smoke Ventilation – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-37
Miscellaneous Electrical Areas Smoke Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Flexible connection	Pressure boundary

References

UFSAR: 9.4.1.3, Appendix 9A.4.3, 9.4.12.2.8, Appendix 9A.2.3.4, Appendix 9A.5 [Position D.3(i)]

License Renewal Drawings: 912-0633

2.3.3.38 Miscellaneous Sump (G60)

System Description

The miscellaneous sumps system provides a means of collecting and routing drainage in the circulating water pumphouse, service water pumphouse, and emergency service water pumphouse to their respective floor drain sumps, and for the removal of this collected drainage to the respective pumphouse forebay. This system also provides for the removal of collected water in the service water valve pit to ground level using an installed pump, and for pump-out of selected manholes to catch basins.

System Boundary

System components subject to aging management review include the nonsafety sump discharge piping within the safety-related service water valve pit, as shown on the LR boundary drawing.

The portions of the nonsafety-related sump pump that is submerged in the service water valve pit sump cannot cause spatial interactions with nearby safety-related equipment (i.e., by leaking or spraying below the waterline). Only the pump discharge piping and bolting above the waterline are within scope.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Collect and route drainage for selected structures.

Component Types Subject to Aging Management Review

Table 2.3.3-38 lists the component types that require aging management review and their intended functions.

Table 3.3.2-38, Auxiliary Systems – Miscellaneous Sump – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-38
Miscellaneous Sump
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Piping	Leakage boundary

References

UFSAR: 3.8.4

License Renewal Drawings: 302-0331

2.3.3.39 Nitrogen Supply (P86)

System Description

The nitrogen supply System supplies nitrogen gas to the scram accumulators of the hydraulic control units associated with the control rod drive hydraulic system (C11).

The system consists of a nitrogen storage vessel, a tube trailer discharging stanchion, pressure reducing valves, and the associated piping to distribute the nitrogen to hose connections located within the proximity of the hydraulic control units.

Other than safety-related piping and isolation valves associated with the piping penetration into containment, the system is nonsafety-related.

System Boundary

System components subject to aging management review include safety related valves and piping components associated with a containment penetration, and the connected nonsafety valves and piping components that provide support, as shown on LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Supply nitrogen gas to the scram accumulators of the Hydraulic Control Units.

Component Types Subject to Aging Management Review

Table 2.3.3-39 lists the component types that require aging management review and their intended functions.

Table 3.3.2-39, Auxiliary Systems – Nitrogen Supply System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-39
Nitrogen Supply
Component Types Subject to Aging Management Review

Component Type	Intended function
Piping	Pressure boundary, Structural integrity
Valve body	Pressure boundary, Structural integrity

References

UFSAR: N/A

License Renewal Drawings: 302-0950

2.3.3.40 Nuclear Closed Cooling (P43)

System Description

The nuclear closed cooling system (NCC) is designed to provide a reliable source of cooling water to the auxiliary nuclear plant equipment.

The system flow is maintained by the necessary combinations of three 50 percent capacity pumps with three 50 percent capacity heat exchangers dissipating the heat load to the service water system. A surge tank is also provided to account for system volume variations. Two pumps are powered from Unit 1 diesel backed ac power sources; the third pump is powered from a Unit 2 ac power source. The pumps are manually initiated and operated. Under a loss of preferred ac power, the system can be manually restarted and loaded onto the emergency diesel stub bus.

The nuclear closed cooling system is not required for safe shutdown of the reactor following a loss-of-coolant accident. Upon a signal in the control room of accident conditions, the “A” and “B” NCC pumps are shut down and the containment isolation valves are closed. The fuel pool heat exchanger equipment isolation valves are also automatically closed. Cooling is then restored from the Unit 2 emergency closed cooling system.

System Boundary

System components subject to aging management review are limited to safety-related valves and piping associated with containment penetrations, and nonsafety-related pumps, tanks, heat exchangers, valves and various other piping components within structures that contain safety-related components, as shown on the LR boundary drawings.

The Recirculation pump seal water coolers which act as a pressure boundary within the reactor coolant pressure boundary are addressed as part of the reactor coolant pressure boundary scoping.

Safety related piping that supplies NCC cooling to the fuel pool cooling and cleanup (G41) heat exchangers and the control complex chilled water (P47) system chiller C, by way of the emergency closed cooling water (P42) system piping is addressed as part of the emergency closed cooling water system scoping.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

Drywell isolation valves ensure drywell boundary. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains component credited for EQ. [10 CFR 54.4(a)(3) - EQ]

Remove heat from equipment required for power production.

Component Types Subject to Aging Management Review

Table 2.3.3-40 lists the component types that require aging management review and their intended functions.

Table 3.3.2-40, Auxiliary Systems – Nuclear Closed Cooling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-40
Nuclear Closed Cooling
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Heat exchanger (Air compr jacket)	Leakage boundary
Heat exchanger (Channel)	Leakage boundary
Heat exchanger (Header)	Leakage boundary
Heat Exchanger (Plate)	Leakage boundary
Heat exchanger (Shell)	Leakage boundary
Heat exchanger (Tube)	Leakage boundary
Orifice	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Strainer body	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 9.2.8.1, 9.2.8.2, 9.2.8.3, Appendix 1A Table 1A-1 Item No. II.K.3.25, Table 3.2-1 note 19

License Renewal Drawings: 302-0611, 302-0612, 302-0613, 352-0612

2.3.3.41 Offgas Building Ventilation (M36)

System Description

The offgas building exhaust system exhausts air from the offgas building and from potentially contaminated areas like the steam jet air ejector area, catalytic recombiner area, and various rooms and equipment cells in the condensate polishing area. This exhaust air passes through a charcoal filter train before it is discharged to the atmosphere through an elevated release point (offgas vent duct). The offgas exhaust system is operated continuously during normal operation.

The main components of this system are located in the offgas building at elevation 635'-0," and consist of two 100 percent capacity charcoal filter trains and two 100 percent capacity centrifugal fans with isolation dampers for idle unit isolation. The charcoal filter trains include roughing filters, HEPA prefilters, charcoal filters, and HEPA after-filters.

Components of this system located in the turbine building, turbine power complex, and located above elevation 660' of the offgas building are nonsafety class and are of standard industrial design. Components located below elevation 660' of the offgas building are designed to satisfy system space requirements and to satisfy the requirements for Safety Class 3 and Seismic Category I items.

System Boundary

System components subject to aging management review include safety related ventilation fans, filter plenums and associated duct components, safety related dampers and fire dampers, along with nonsafety-related duct components, dampers, filter drain piping and valves, as shown on the LR boundary drawing.

Fire protection fluid components are evaluated in the fire protection system (P54).

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

Offgas ventilation exhausts air from turbine power complex, and turbine and offgas buildings through a filter. [10 CFR 54.4(a)(1), (a)(2)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

System fire dampers prevent the spread of fires. [10 CFR 54.4(a)(3) – FP]

Component Types Subject to Aging Management Review

Table 2.3.3-41 lists the component types that require aging management review and their intended functions.

Table 3.3.2-41, Auxiliary Systems – Offgas Building Ventilation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-41
Offgas Building Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Filter plenum	Pressure boundary
Flexible connection	Pressure boundary
Flow element	Pressure boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 7.6.1.10, 9.4.4.2.3, Appendix 9A.4.13.1, 15.7.1

License Renewal Drawings: 302-0751, 302-0752, 912-0622

2.3.3.42 Penetration Electrical (R72)

System Description

Electrical penetrations provide for the transition of electrical cables through the containment barrier while maintaining containment integrity.

Any deterioration of the electrical penetration epoxy insulation is monitored by a leakage monitoring system using nitrogen. During normal operation, the nitrogen pressure will be kept at or above 10 psig, the PNPP containment accident pressure plus margin. This pressure is maintained in a very small volume between the seals of each penetration module to achieve high sensitivity in leak monitoring. Penetration pressures are routinely inspected during plant operation to assure prompt detection of leaky penetrations.

The system includes nonsafety-related piping, valves and nitrogen bottles used to maintain electrical penetrations pressurized with nitrogen.

System Boundary

There are no mechanical system components subject to aging management review. The penetration components that support containment pressure boundary integrity are evaluated as structural components.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Maintain containment integrity [10 CFR 54.4(a)(1), but this function is not performed by mechanical components]

The system contains components credited with compliance with 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Support monitoring of penetration integrity.

Component Types Subject to Aging Management Review

None. The penetrations are evaluated as structural commodities.

References

UFSAR: 8.3.1.4.5, Fig. 3.8-7

License Renewal Drawings: N/A

2.3.3.43 Penetration Pressurization (P53)

System Description

The penetration pressurization system serves as a testing system which measures leakage rates from penetrations after being pressurized with air.

Leakage from the personnel air locks is also controlled by this system by placing a vacuum on the space between the pair of door seals on the outer doors of the personnel air locks. The vacuum between the door seals is created by routing a small line into the containment annulus. The containment annulus is kept at a slight negative pressure by the annulus exhaust gas treatment system. Any bypass leakage past the personnel airlock outer door seals is routed back into the containment annulus where it is sent to the annulus exhaust gas treatment system. This system is classified as Safety Class 2 and is designed to survive and function through a single active failure.

The function of the pneumatic air lock seal pressurization system is to provide air to the inflatable seals and accumulator tanks on the airlock doors. Each personnel air lock door has two inflatable seals. The seals, when inflated impinge upon stainless steel surfaces in the door jamb.

System Boundary

System components subject to aging management review include safety-related air tanks, valves and piping components that support penetration testing and the nonsafety piping directly attached to the safety-related piping as shown on the LR boundary drawings.

The containment personnel access airlocks, containment equipment access hatch and the drywell personnel access airlock are reviewed as part of their respective structures.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

Control airlock leakage [10 CFR 54.4(a)(1)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Measure containment penetration leakage rates

Component Types Subject to Aging Management Review

Table 2.3.3-43 lists the component types that require aging management review and their intended functions.

Table 3.3.2-43, Auxiliary Systems – Penetration Pressurization System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-43
Penetration Pressurization
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary, Structural integrity
Flexible hose	Pressure boundary
Orifice	Flow restriction, Pressure boundary
Piping	Pressure boundary, Structural integrity
Tank	Pressure boundary
Valve body	Pressure boundary, Structural integrity

References

UFSAR: 6.2.6.2, Appendix 9A.7

License Renewal Drawings: 302-0761, 302-0762

2.3.3.44 Plant Foundation Underdrain (P72)

System Description

The main objective of the pressure relief underdrain system is to ensure that the groundwater level around the nuclear island does not exceed elevation 590.0 feet. Safety-related structures serviced by the underdrain system are designed to withstand all loading conditions at this maximum level.

The underdrain system consists of a porous concrete blanket, nominally one foot thick, which underlies all of the structures of the nuclear island. Between some of the buildings and around the perimeter of the nuclear island, the blanket is increased in thickness to incorporate a one-foot diameter porous concrete pipe. The pipe carries the collected water to individual pumps located in manholes on the East and West sides of the nuclear island. The underdrain pumps discharge into the gravity discharge system and drain to Lake Erie via the emergency service water pumphouse.

This system includes two discharge systems (pumping and gravity drain). In the pumped discharge system, the design groundwater inflow of 80 gpm flows by gravity through the porous concrete blanket and pipes to collection manholes containing the service underdrain pumps.

Three service underdrain pumps are set to maintain a water surface elevation of 568.0' or below. If for some reason the pumps fail to start or cannot keep up with the rising water level, then, a high water level alarm will sound in the control room and a backup pump in manhole #6 will automatically start, providing an additional 50 gpm nominal capacity to the pumping discharge system.

Should all of the underdrain service pumps and the backup pumps fail, the groundwater level would rise until it reaches the gravity drain discharge system which is provided to ensure that the groundwater level around the nuclear island never exceeds elevation 590.0’. The gravity discharge drain system is designed to provide a redundant periphery discharge which incorporates a gravity outfall, having no active components, to handle a 15,000 gpm flow entering the underdrain system on either side of the plant.

Postulating an accidental release of radioactive materials occurring at the radwaste building of the PNPP, the pumps installed in the pumping manholes of the pressure relief underdrain system will be manually shut off, allowing groundwater to build up to the gravity drain discharge elevation and discharge via the gravity drains to the emergency service water pumphouse and eventually into Lake Erie.

The manholes (structures) are seismic Category I, and the gravity drain piping is safety-related. There are no safety-related components within the manholes to be protected from leakage.

System Boundary

System components subject to aging management review are limited to the safety-related gravity drain piping between manholes, and to the emergency service water pumphouse, as shown on the referenced LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event.

Prevent the buildup of hydrostatic pressures under the building foundations from exceeding a condition equivalent to a static water surface elevation of 590.0’. [10 CFR 54.4(a)(1)]

Maintain groundwater level below 575.0 ft elevation under normal operating conditions to allow time for radioactive isotopes to decay prior to discharging groundwater to the lake in the event of a design basis accident (liquid radwaste tank failure).

The plant operating procedures require that upon indication of a seismic event or unexpected high radiation levels in the radwaste building, the service and backup underdrain pumps are manually tripped with a positive, safety-related cutoff switch. [10 CFR 54.4(a)(1) electrical only].

Component Types Subject to Aging Management Review

Table 2.3.3-44 lists the component types that require aging management review and their intended functions.

Table 3.3.2-44, Auxiliary Systems – Plant Foundation Underdrain System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-44
Plant Foundation Underdrain
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Piping	Pressure boundary

References

UFSAR: 2.4.13.3, 2.4.13.5.1, 2.4.13.5.2, 15.7.3.2, 15.7.3.5

License Renewal Drawings: 302-0861

2.3.3.45 Plant Radiation Monitoring and Process Monitoring (D17), and Post Accident Radiation Monitoring (D19)

System Description

This system consists of airborne radiation monitors, gaseous process and effluent radiation monitors, liquid process and effluent radiation monitors, and post-accident radiation monitors. The intermediate building ventilation system (M33) flow straighteners in the Unit 1 and 2 plant Vents are also evaluated within this system.

Airborne radiation monitoring:

An airborne radiation monitor typically consists of a particulate measuring channel, an iodine measuring channel and a gas measuring channel. A representative sample of air from a ventilation duct is drawn through a sample line to the airborne monitor unit by means of an air blower. Sampling of the ducts is achieved using an isokinetic sample probe placed in the air stream. The sample passes through a particulate, iodine and gas channel in series. Each channel is independent. In the particulate channel, the sample air passes through a fixed or moving filter which collects particulates and is monitored by a beta scintillation detector, the output of which is pre-amplified and transmitted to a ratemeter located in the control room. In the iodine channel, the sample passes through an activated charcoal cartridge which traps the radioactive iodine. The gas is exhausted back to the ventilation duct. Differential pressure switches across the filter and charcoal cartridges are provided to give a low flow alarm at the unit and in the control room.

Gaseous process and effluent monitoring:

Gaseous process monitors are provided for detecting and monitoring radiation levels in certain plant process streams.

The Gaseous effluent units monitor a sample of the effluent discharge for particulate, iodine and gas radioactivity and provide samples of the collected particulate and halogen for laboratory analysis. For the unit vents a representative sample is continuously extracted from each plant vent through an isokinetic probe. The sample is supplied through a 1-inch sample line which is also used to supply a representative sample to the post-accident effluent radiation monitors. For the offgas and turbine building/heater bay vents a representative sample is continuously extracted from the vent pipe downstream of the exhaust fans.

Liquid process and effluent radiation monitoring:

These units monitor the gamma radiation levels of liquid process and effluent streams. With the exception of the radwaste system effluent, the streams monitored normally contain only background levels of radioactive materials. Increases in radiation level may be indicative of heat exchanger leakage or equipment malfunction.

For each liquid monitoring location, except for the underdrain system, a continuous sample is extracted from the liquid process pipe, passed through a liquid sample panel which contains a detection assembly for gross gamma radiation monitoring, and returned to the process pipe. The detection assembly consists of a scintillation detector mounted in a shielded sample chamber equipped with a check source. A ratemeter in the control room displays the measured gross radiation level and the analog signal is recorded.

Post-accident radiation monitoring:

Some monitors are designated and installed as post-accident radiation instruments. They provide radiation level readings and alarm functions. These monitors include area monitors, vent radioactive gas release monitors and area airborne activity monitors.

System Boundary

System components subject to aging management review include the following, as shown on LR boundary drawings:

- Safety-related post-accident effluent radiation monitors.
- Safety-related air sample piping and the attached nonsafety air sample piping up to an equivalent anchor for the containment and drywell atmosphere monitors,
- Nonsafety-related (liquid) sample piping, valves, pumps and monitor equipment for the ADHR service water, radwaste effluent to ESW, NCC, and ESW loops A and B monitors.

Other radiation monitors either have no passive mechanical components, or do not perform a function corresponding to the criteria in .

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform functions that demonstrates compliance with the regulations for EQ.

Safety-related piping provides system pressure boundary integrity. [10 CFR 54.4(a)(1)]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

Indication from the intermediate building ventilation safety related flow elements (straighteners) is used together with the Unit 1 & 2 plant vent radiation monitors to establish a release rate. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Plant radiation monitoring provides actuation logic to limit radiological release. [10 CFR 54.4(a)(1) applicable only to active electrical components]

Process radiation monitoring systems are provided to monitor and control radioactivity in process and effluent streams and to activate appropriate alarms and controls.

Provide the capability to detect an offgas system failure by an alarmed increase in activity at the plant vent.

Component Types Subject to Aging Management Review

Table 2.3.3-45 lists the component types that require aging management review and their intended functions and Table 2.3.3-45a summarizes the scoping determination for individual monitors.

Table 3.3.2-45, Auxiliary Systems – Plant Radiation Monitoring and Process Monitoring and Post Accident Radiation Monitoring System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-45
Plant Radiation Monitoring and Process Monitoring and Post Accident Radiation Monitoring Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary, Structural integrity
Detector housing	Leakage boundary, Pressure boundary
Filter housing	Pressure boundary
Flexible hose	Leakage boundary
Flow straightener	Pressure boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
Pump casing	Leakage boundary, Pressure boundary
Valve body	Leakage boundary, Pressure boundary, Structural integrity

Table 2.3.3-45a
Scoping Determination for Individual Plant Monitors

The following table summarizes the scoping determination for individual monitors. The safety-related [(a)(1)] determination was based on quality classification. The [(a)(2)] determination was based on location of fluid-filled components. The [(a)(3)] EQ function was determined based on the SAP EQ classification. No CLB (a)(2) or (a)(3) function other than EQ has been identified by review of UFSAR and regulated event bases. Only the shaded monitors have passive components that are within scope.

Monitor		Passive ?	(a)(1)	(a)(2)	(a)(3)	Drawing
EFFLUENT						
Offgas Vent Pipe	1D17K0830	Y	N	N	N	806-0008
Unit 1 Plant Vent	1D17K0780	Y	N	N	N	806-0007

Monitor		Passive ?	(a)(1)	(a)(2)	(a)(3)	Drawing
Unit 2 Plant Vent	2D17K0780	Y	N	N	N	856-0007
Turbine Building/Heater Bay	1D17K0850	Y	N	N	N	806-0023
VENTILATION SYSTEMS						
Containment Vessel and Drywell Purge Exhaust	1D17K0660	Y	N	N	N	806-0006
Annulus Exhaust Train "A"	1D17K0690A	Y	N	N	N	806-0006
Annulus Exhaust Train "B"	1D17K0690B	Y	N	N	N	806-0006
Control Room HVAC and Emerg Recirc	0D17K0770	Y	N	N	N	806-0005
Radwaste Building Ventilation Exhaust	0D17K0720	Y	N	N	N	806-0003
Intermediate Building Ventilation Exhaust	0D17K0730	Y	N	N	N	806-0003
Offgas Building Ventilation Exhaust	1D17K0760	Y	N	N	N	806-0004
Auxiliary Building Ventilation Exhaust	1D17K0700	Y	N	N	N	806-0004
Fuel Handling Building Ventilation Exhaust	0D17K0710	Y	N	N	N	806-0005
ATMOSPHERE (No Ventilation Train)						
Drywell Atmosphere	1D17K0670	Y	Y	N	Y	806-0004
Containment Atmosphere	1D17K0680	Y	Y	N	Y	806-0007

Monitor		Passive ?	(a)(1)	(a)(2)	(a)(3)	Drawing
Miscellaneous						
Steam Packing Exhauster	1D17K0840	N	N	N	N	806-0008
Process Monitors						
ESW Loop A	1D17K0604	Y	N	Y	N	806-0010
ESW Loop B	1D17K0605	Y	N	Y	N	806-0010
Radwaste to ESW	0D17K0606	Y	N	Y	N	806-0009
NCC	0D17K0607	Y	N	Y	N	806-0009
ADHR Serv Wtr	1D17K0608	Y	N	Y	N	806-0009
Offgas Pre-treatment	1D17K0612	Y	N	N	N	806-0018
Offgas Post-treatment A	1D17K0601A	Y	N	N	N	806-0019
Offgas Post-treatment B	1D17K0601B	Y	N	N	N	806-0019
Containment Ventilation Exhaust A-D	1D17K0609A-D	N	Y	N	N	912-0604 806-0024
Main Steam Line A-D	1D17K0610A-D	N	Y	N	Y	806-0024
Carbon Bed Vault A	1D17K0611A	N	N	N	N	806-0025
Carbon Bed Vault B	1D17K0611B	N	N	N	N	806-0025
Underdrain Manhole 23	0D17K0820A	N	N	N	N	806-0017
Underdrain Manhole 20	0D17K0820B	N	N	N	N	806-0017
Post-Accident Monitors						
Drywell & Rx Bldg. A	1D19K0100	N	Y	N	Y	806-0033

Monitor		Passive ?	(a)(1)	(a)(2)	(a)(3)	Drawing
Drywell & Rx Bldg. B	1D19K0200	N	Y	N	Y	806-0033
TSC Area	1D19K0650	N	N	N	N	806-0034
Plant Vent Gas (Unit 1)	1D19K0300	Y	Y	N	N	806-0033
Off-Gas Vent Gas	1D19K0400	Y	Y	N	N	806-0033
Turb/Heater Bay Vent Gas	1D19K0500	Y	Y	N	N	806-0033
Plant Vent Gas (Unit 2)	2D19K0300	Y	Y	N	N	856-0033
TSC Airborne	0D19K0600	Y	N	N	N	806-0034

References

UFSAR: 1.2.2.10.1, 15.7.1.1.2.b, 11.5, 12.3.4

License Renewal Drawings: 806-0004, 806-0007, 806-0009, 806-0010, 806-0033, 856-0033, 912-0613

2.3.3.46 Post-Accident Sampling (P87)

System Description

The post-accident sampling system (PASS) permits sampling of the containment building environments and the reactor coolant systems after a loss-of-coolant accident (LOCA). Sample analysis can be performed by using either onsite or offsite analytical instruments.

The sampling station is centrally located in the intermediate building along the wall which separates the control complex from the intermediate building at elevation 574'-10". Samples are drawn individually from the following points:

- Drywell atmosphere
- Containment atmosphere
- Suppression pool atmosphere

- Annulus atmosphere
- Reactor water recirculation system - 2 points
- Reactor water cleanup system - 3 points
- Residual heat removal system - 2 points
- Drywell floor drain sump
- Suppression pool

Liquid sample streams drawn from selected sample locations pass through a remotely located cooler rack to the grab sample panel. Atmospheric samples drawn from any one of the four selected sample locations flow to the grab sample panel. Each sample is collected in a sample bottle for analysis.

Demineralized water is supplied to the sampling station for decontamination of the sampling station plenums, flushing of liquid sample lines and dilution of liquid samples. Nitrogen is supplied to the sampling station for drying of the sample lines and various components, and for purging of gas sample lines.

PNPP License Amendment 124 deleted Technical Specification 5.5.3, "Post Accident Sampling System (PASS)," and thereby eliminated the requirements to have and maintain the PASS at PNPP, Unit 1. Portions of the system remain safety-related to maintain system and containment integrity.

System Boundary

System components subject to aging management review include pumps, heat exchangers, sample panels, valves and piping components as shown on the LR boundary drawing.

Both the grab sample panel and the chemical sample panel are designed to contain and control leakage and spills within the panels. As such, the panels themselves provide a leakage barrier function such that leakage of internal panel components will not result in spatial impact to nearby safety-related components.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Support sampling of the containment building environments and the reactor coolant systems.

Component Types Subject to Aging Management Review

Table 2.3.3-46 lists the component types that require aging management review and their intended functions.

Table 3.3.2-46, Auxiliary Systems – Post-Accident Sampling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-46
Post-Accident Sampling
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Heat exchanger (Sample cooler channel)	Leakage boundary
Heat exchanger (Sample cooler shell)	Leakage boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
Pump casing	Leakage boundary
Sample panel (housing)	Leakage boundary
Valve body	Leakage boundary, Pressure boundary, Structural integrity

References

UFSAR: 9.3.6, 9.3.6.2, 9.3.6.3

License Renewal Drawings: 302-0431

2.3.3.47 Potable Water Supply (P71)

System Description

The potable water system supplies and distributes both hot and cold water throughout the plant for potable and sanitary purposes.

The supply of potable and sanitary water is obtained from the Lake County Department of Utilities water main, which is extended onto the site. Potable water is distributed to the plumbing fixtures located in the plant.

Hot water is generated by two large electric hot water storage heaters located in the service building and the control complex. Small electric water heaters are located in the turbine building. Hot water recirculating systems are used where excessive lengths of hot water piping warrant inclusion of such systems to maintain water temperature.

The potable water system is not nuclear safety-related.

System Boundary

System components subject to aging management review include a pump, tanks, valves and piping components within safety-related structures, as shown on the referenced LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Distribute hot and cold water throughout the plant for potable and sanitary purposes.

Component Types Subject to Aging Management Review

Table 2.3.3-47 lists the component types that require aging management review and their intended functions.

Table 3.3.2-47, Auxiliary Systems – Potable Water Supply System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-47
Potable Water Supply
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Eyewash station	Leakage boundary
Flexible hose	Leakage boundary
Piping	Leakage boundary
Pump casing	Leakage boundary
Tank (Water heater lining)	Leakage boundary
Tank (Water heater)	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.2.4, 9.2.4.2, 9.2.4.3

License Renewal Drawings: 302-0382, 919-0022

2.3.3.48 Rx Plant Sampling (P35)

System Description

The Rx plant sampling system is a process sampling system provided to permit monitoring of equipment and system performance (chemistry) during normal plant operation. Information gathered by the process sampling system is used to make operational decisions for the plant but is not used for reactor shutdown or accident mitigation.

The Rx plant sampling system consists of the following sample stations in the containment building:

1. Reactor water cleanup filter/demineralizer inlet header.
2. Each reactor water cleanup filter/demineralizer outlet.
3. One reactor water recirculation loop.
4. Control Rod Drive water

This system does not include sample points provided for process and effluent radiological monitoring. Such sample points are addressed in plant radiation monitoring and post-accident radiation monitoring systems (D17 and D19, respectively). In addition, there are numerous local grab sample locations that are part of their parent systems.

System Boundary

P35 reactor plant sampling system components subject to aging management review include nonsafety-related valves, heat exchangers, sample sink and piping as shown on the LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of non-safety related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Monitor equipment and system performance (chemistry) during normal plant operation.

Component Types Subject to Aging Management Review

Table 2.3.3-48 lists the component types that require aging management review and their intended functions.

Table 3.3.2-48, Auxiliary Systems –Rx Plant Sampling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-48
Process Sampling (Rx Plant Sampling)
Component Types Subject to Aging Management Review

Component Type	**Intended function**
Bolting	Leakage boundary
Filter housing	Leakage boundary
Heat exchanger (Sample bath coil)	Leakage boundary
Heat exchanger (Sample bath shell)	Leakage boundary
Heat exchanger (Sample cooler shell)	Leakage boundary
Piping	Leakage boundary
Sample sink	Leakage boundary
Sight glass	Leakage boundary

Sight glass (Body)	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.3.2, 9.3.2.2.1

License Renewal Drawings: 302-0772

2.3.3.49 Radwaste Building Ventilation (M31)

System Description

The radwaste building ventilation supply system operates continuously to provide filtered air to various areas of the radwaste building. The exhaust system operates continuously to exhaust these areas and to direct this exhaust through a charcoal filter plenum to the unit vent. The supply system consists of one 100 percent capacity supply plenum which houses roughing filters and hot water heating coils, two 100 percent capacity supply fans and supply distribution ducts. The exhaust system consists of two 100 percent capacity filter plenums, housing roughing, HEPA, charcoal and a second bank of HEPA filters, two 100 percent capacity exhaust fans and exhaust distribution ducts. During periods of emergency, system operation is not required to safely shut down the plant.

System Boundary

System components that are subject to aging management review are limited to fire dampers, as shown on the LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

System fire dampers prevent the spread of fire. [10 CFR 54.4(a)(3) – FP]

Provide filtered ventilation to radwaste building areas.

Minimize the release of activity to the environment in accordance with Reg Guide 1.140.

Component Types Subject to Aging Management Review

Table 2.3.3-49 lists the component types that require aging management review and their intended functions.

Table 3.3.2-49, Auxiliary Systems – Radwaste Building Ventilation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-49
Radwaste Building Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Damper housing	Pressure boundary

References

UFSAR: 9.4.3.2.3

License Renewal Drawings: 912-0612

2.3.3.50 Reactor Vessel Servicing Equipment (F13)

System Description

The system consists of tools and equipment used when the reactor is shut down and being disassembled or assembled. The system contains safety-related civil components that are used for lifting or storing the reactor components. The system contains components such as the safety related main steam line plugs and nonsafety-related temporary isolation devices that are used in support of maintenance to prevent drain down of upper pool water during refueling.

System Boundary

There are no mechanical components in the system that are subject to aging management.

Safety-related civil components that are used for lifting or storing the reactor components are evaluated under structural.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains both safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event. This scoping determination applies to temporarily installed components in support of maintenance that are subject to periodic removal and inspection. There are no mechanical system components subject to aging management within the scope of License Renewal.

Ensure reactor water level is greater than 23 feet over fuel assemblies during a Fuel Handling Accident inside Containment [(a)(1) - Steam line plugs, not permanently installed components and are subject to periodic removal and inspection].

The system supports reactor assembly and disassembly.

Temporary Isolation Devices used for maintenance activities are controlled by Tech Spec 3.5.2, RPV Inventory Control, to prevent an RPV draining event below the top of active fuel (TAF) [(a)(2) - not permanently installed components and are subject to periodic removal and inspection]

Component Types Subject to Aging Management Review

None

Table 3.3.2-50, Auxiliary Systems – Reactor Vessel Servicing Equipment – Summary of Aging Management Evaluation, was added for completeness. There are no components subject to aging management review.

References

UFSAR: 3.2.3.2.2, 9.1.4.2.5, 15.7.6.4.1.b.2, Table 9.1-5

License Renewal Drawings: N/A

2.3.3.51 Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer (G33 & G36)

System Description

The reactor water cleanup (RWCU) system recirculates a portion of reactor coolant through a filter demineralizer to remove particulate and dissolved impurities from the reactor coolant. It also removes excess coolant from the reactor system under controlled conditions.

The system can take suction from the inlet of each reactor main recirculation pump and from the reactor pressure vessel bottom head. The process fluid is circulated with the cleanup pumps through regenerative and nonregenerative heat exchangers for cooling, through the filter demineralizers for cleanup and back through the regenerative heat exchangers for reheating. The processed water is returned to the RPV, the main condenser or radwaste.

System Boundary

System components subject to aging management review include the RWCU pumps, valves, filter-demineralizers, heat exchangers, valves, and piping components as shown on LR boundary drawings.

The ASME Class 1 portions of the system are evaluated with the reactor coolant pressure boundary system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ and SBO.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1), (a)(3) - SBO]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Maintain the reactor water within acceptable conductivity and chemistry limits.

Control Reactor Pressure Vessel level during shutdowns.

Remove decay heat from the reactor vessel under certain conditions.

Component Types Subject to Aging Management Review

Table 2.3.3-51 lists the component types that require aging management review and their intended functions.

Table 3.3.2-51, Auxiliary Systems – Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer (G33 & G36) – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-51
Reactor Water Clean Up and
Reactor Water Clean Up Filter Demineralizer (G33 & G36)
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Filter-demin housing	Leakage boundary
Filter housing	Leakage boundary
Flow restrictor	Leakage boundary
Heat exchanger (Channel)	Leakage boundary
Heat exchanger (Shell)	Leakage boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Sight glass	Leakage boundary
Sight Glass (Body)	Leakage boundary
Strainer body	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 1.1.2.3.5, 5.4.8, Appendix 15C, Appendix 15H.2

License Renewal Drawings: 302-0078, 302-0671, 302-0672, 302-0675, 302-0737

2.3.3.52 Safety Related Instrument Air (P57)

System Description

The safety-related instrument air system supplies clean, dry, oil-free air to the automatic depressurization system (ADS) safety relief valve accumulators to support operation of the safety relief valves. The "B" train safety-related instrument air system also provides post-accident makeup to the outboard MSIV air accumulators. Air receiver tanks are sized by volume to provide a sufficient quantity of air for recharging the ADS accumulators, outboard MSIV accumulators and the low-low set relief valve accumulator under accident conditions. In addition, the tanks contain a sufficient volume of air to provide makeup for system leakage for a period of seven days after an accident occurs.

Compressed air is provided by a reciprocating type air compressor and air dryer. The system has a connection for recharging the receiver tanks or safety relief valve accumulators directly to supplement compressor recharging in emergency and normal situations when the compressor is out-of-service.

One large, low pressure air receiver tank is provided for safety-related air storage in each of two supply lines for the ADS and low-low set relief valve accumulators. Two small air receiver tanks are also provided in each supply line to supply nonsafety air storage to minimize compressor cycling. Only the large air receiver tanks are designated as Safety Class 3; the small air receiver tanks are designated as nonsafety class.

System Boundary

System components subject to aging management review include safety-related tanks, valves and piping components, as well as nonsafety-related valves and piping components as shown on the LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for FP, EQ and SBO.

Provide compressed air to automatic depressurization system (ADS) safety relief valve (SRV) and to one Low Low Set of SRV accumulators. [10 CFR 54.4(a)(1), (a)(3) – FP, SBO]

Provide compressed air to outboard main steam isolation valve (MSIV) accumulators. [10 CFR 54.4(a)(1)]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/non-safety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Component Types Subject to Aging Management Review

Table 2.3.3-52 lists the component types that require aging management review and their intended functions.

Table 3.3.2-52, Auxiliary Systems – Safety Related Instrument Air System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-52
Safety Related Instrument Air
Component Types Subject to Aging Management Review

Component Type	**Intended function**
Bolting	Leakage boundary, Pressure boundary, Structural integrity
Piping	Leakage boundary, Pressure boundary, Structural integrity
Tank (Air storage)	Pressure boundary, Structural integrity
Tank (Condensate receiver / separator)	Leakage boundary
Valve body	Leakage boundary, Pressure boundary, Structural integrity

References

UFSAR: 6.8.1, 6.8.2, Appendix 15H

License Renewal Drawings: 302-0271

2.3.3.53 Sanitary Drain and Sewer (P66)

System Description

The sanitary drains and sewer system consists of a series of drain and vent piping that gravity drains from various sinks, drains and sanitary appliances throughout the control complex to the 574' level of the control complex. Two ejectors then pump the waste to the sewage pumping station in the yard.

The control room envelope is provided with fire protection equipment, adequate lighting, communications equipment, kitchen, sanitary, administrative and storage facilities, and spaces necessary to perform the normal plant operations required to maintain the plant in a safe condition following an accident.

System Boundary

System components subject to aging management review are limited to the nonsafety-related fluid piping components within structures that contain safety-related components, as shown on the LR boundary drawings. With the exception of the sanitary loop seals within the control room envelope, the control room envelope boundary is addressed as part of structural scoping.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Maintain the control room habitability boundary. [10 CFR 54.4(a)(2) (Structural scoping)]

Sanitary loop seals within the control room envelope are required to support the integrity of the control room envelope boundary. [10 CFR 54.4(a)(2)]

Collect sewage and wastewater from various locations throughout the Control Complex and transfer this waste to the sewage pump station.

Component Types Subject to Aging Management Review

Table 2.3.3-53 lists the component types that require aging management review and their intended functions.

Table 3.3.2-53, Auxiliary Systems – Sanitary Drain and Sewer – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-53
Sanitary Drain and Sewer
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Pump casing (sewage ejector)	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 6.4.1

License Renewal Drawings: 919-0022

2.3.3.54 Service Air (P51) and Instrument Air (P52)

System Description

The compressed air systems include the instrument air system and the service air system. The safety-related instrument air system (P57) is addressed separately.

The service air system consists of two motor-driven compressors (the Unit 2 compressor is located in the control complex building, and is used to support Unit 1 operation), each with an integral intercooler and aftercooler, an air intake filter silencer, lube oil subsystem, filters, condensate traps, controls, a receiver tank, and a piping network for distribution throughout the plant.

The service air compressors are each sized to provide the normal load capacity for the entire plant. During normal operation, one compressor is running and the other is in the automatic standby mode. The service air compressor is operated continuously to provide a nominal output pressure. If the service air system pressure drops below a set value, the standby air compressor starts automatically and restores system pressure to the normal range.

A separate instrument air system is provided to supply clean, dry, oil free air for control purposes throughout the plant. The normal supply of air to the instrument air system is from the service air system, and the instrument air compressor for each unit (the Unit 2 compressor is located in the control complex building and is used to support Unit 1 operation) is used as a backup. Each instrument air compressor also includes an after cooler (integral with the compressor), a receiver tank, a prefilter, an air dryer, an after-filter, and a piping network for distribution throughout the plant. All instrument air leaving the receiver tank passes through the filters and the air dryer.

Except for that portion between the containment isolation valves, the instrument air and service air systems are nonsafety-related. All safety-related components using compressed air are either designed to fail to a condition that corresponds with the safe shutdown of the reactor plant or are equipped with accumulators to satisfy their required air demands.

System Boundary

System components subject to aging management review include safety-related containment and drywell penetration piping components, the nonsafety piping directly attached to the safety-related piping, and valves and other piping components associated with condensation drains as shown on the LR boundary drawings. Various compressor oil subcomponents not shown on the boundary drawings are also subject to aging management review.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

Ensure drywell boundary. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Supply air to the instrument air system.

Supplies filtered and dried compressed air to plant distribution headers.

Component Types Subject to Aging Management Review

Table 2.3.3-54 lists the component types that require aging management review and their intended functions.

Table 3.3.2-54, Auxiliary Systems – Service Air and Instrument Air System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-54
Service Air and Instrument Air
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary, Structural integrity
Drain trap	Leakage boundary
Flexible hose	Pressure boundary
Piping	Leakage boundary, Pressure boundary, Structural integrity
Pump casing (Compressor oil)	Leakage boundary
Sight glass	Leakage boundary
Sight glass (Body)	Leakage boundary
Tank (Compressor oil)	Leakage boundary
Valve body	Leakage boundary, Pressure boundary, Structural integrity

References

UFSAR: 9.3.1, 9.3.1.1, 9.3.1.2

License Renewal Drawings: 302-0241, 302-0242, 302-0243, 302-0244, 302-0762, 352-0241

2.3.3.55 Service Water (P41)

System Description

The service water system consists of an open loop piping network in which lake water from the cooling water intake structure is pumped through the tube side of the shell and tube type heat exchangers being cooled and directed as necessary to the cooling tower basin as makeup. That amount of water not required for makeup is returned to the lake by way of the discharge tunnel water return line. The system includes four one-third capacity vertical wet pit pumps, automatic self-cleaning strainers, and a piping network to distribute cooling water to the tube side of the heat exchangers being cooled.

The service water system is nonsafety-related and is not required for the safe shutdown of the reactor. For the postulated case of (circulating water) expansion joint rupture and resultant turbine building flooding, two Safety Class III, Seismic Category I motor-operated butterfly valves provided in the makeup line to the cooling towers will be automatically closed, thereby limiting the flooding to the water volume in the cooling tower basin.

The cooling water for the alternate decay heat removal (ADHR) heat exchanger, and the air conditioning units for the ADHR heat exchanger area and low pressure core spray (LPCS) pump room is provided by the service water system.

System Boundary

System components subject to aging management review are limited to the safety-related valves and piping within the valve pit (that function to isolate makeup to circulating water on high water level in the turbine basement), and nonsafety-related piping components within structures that contain safety-related components, as shown on the LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Isolate the cooling tower make-up supply to mitigate the extent of turbine building flooding. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

The integrity of nonsafety-related, fluid-retaining service water piping in the Unit 1 and 2 auxiliary buildings precludes internal flooding that could affect safety-related components. [10 CFR 54.4(a)(2)]

Service water pump B automatic restart following the loss-of offsite power (LOOP) event enables the supply of cooling water to the NCC heat exchanger so that control rod drive can be restored.

Provide cooling water to various auxiliary heat exchangers for the power conversion process.

Provide cooling water to the alternate decay heat removal heat exchanger and associated AC units during modes 4 and 5 for equipment outages.

Provide makeup water to maintain cooling tower basin level.

Provide keepfill water to each of the three trains (A, B, and C) of emergency service water when the respective emergency service water pump is not running.

Component Types Subject to Aging Management Review

Table 2.3.3-55 lists the component types that require aging management review and their intended functions.

Table 3.3.2-55, Auxiliary Systems – Service Water System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-55
Service Water
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Filter housing	Leakage boundary
Flexible hose	Leakage boundary
Orifice	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Strainer body	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 3.6.2.3.5.2, 9.2.7.1, 9.2.7.2, 9.2.7.3, 9.2.10

License Renewal Drawings: 302-0212

2.3.3.56 Standby Liquid Control (C41)

System Description

The standby liquid control system (SLCS) provides backup capability for reactivity control, independent of normal reactivity control provisions, and is able to shut down the reactor if normal control becomes inoperative. The system makes possible an orderly and safe shutdown in the event that not enough control rods can be inserted into the reactor core to accomplish shutdown in the normal manner. The backup system has the capacity for controlling the reactivity difference between the steady-state rated operating condition of the reactor with voids and the cold shutdown condition, including shutdown margin, to ensure complete shutdown from the most reactive condition at any time in core life.

The SLCS is manually initiated in the main control room to pump a boron neutron absorber solution into the reactor if the operator determines the reactor cannot be shut down or maintained shut down with the control rods.

The specified neutron absorber solution is a mixture of sodium borate (borax-$Na_2B_4O_7 \cdot 10H_2O$) and boric acid (H_3BO_3). The solution is prepared by dissolving borax and boric acid in demineralized water in a nominal Na_2O:B_2O_3 molar ratio of 0.229.

Following SLCS injection, the SLC transfer system supports the main injection system by providing capability to add additional batches of borax-boric acid to the main SLC storage tank. The transfer system allows plant personnel to mix these additional batches of borax-boric acid without entering the containment.

An alternate boron injection system is provided to address an ATWS event coupled with the loss of both trains of the standby liquid control (SLC) system, which is a beyond design bases event. The alternate boron injection system design is nonsafety-related.

System Boundary

System components subject to aging management review include tanks, pumps, valves and piping components associated with standby liquid control and alternate boron injection as shown on the LR boundary drawings. ASME Class 1 piping components that provide reactor coolant pressure boundary and containment integrity are evaluated with the reactor coolant pressure boundary evaluation.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform functions that demonstrates compliance with the regulations for ATWS and EQ.

SLCS injects a neutron absorbing boron solution of sufficient concentration, temperature and quantity into the RPV for reactivity control. [10 CFR 54.4(a)(1), (a)(3) - ATWS]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

For the design basis LOCA analysis SLC is used to maintain pH of the Suppression Pool. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

The alternate boron injection system provides an alternate means to inject a neutron absorbing solution into the reactor core, via high pressure core spray, if the normal SLC is not available or is not effective in shutting down the reactor.

Component Types Subject to Aging Management Review

Table 2.3.3-56 lists the component types that require aging management review and their intended functions.

Table 3.3.2-56, Auxiliary Systems – Standby Liquid Control System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-56
Standby Liquid Control
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Flexible hose	Leakage boundary
Flow indicator	Leakage boundary
Orifice	Flow restriction, Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary, Pressure boundary
Tank	Leakage boundary, Pressure boundary
Tank (Heater flange)	Leakage boundary, Pressure boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 1.2.2.4.19, 3.11.5.1.2, 9.3.5.2, Appendix 15C

License Renewal Drawings: 302-0691, 302-0692

2.3.3.57 Steam Tunnel Cooling (M47)

System Description

The steam tunnel cooling system (STCS) operates continuously to provide filtered and cooled air to the steam tunnel. Cooling air is directed from the auxiliary building general area through the cooling plenum, to the steam tunnel, and is then relieved to the turbine building and to the auxiliary building exhaust system. The STCS consists of one 100 percent capacity supply plenum which houses roughing filters and chilled water cooling coils, two 100 percent capacity supply fans, supply and relief distribution ducts.

The STCS is classified as nonsafety-related and non-seismic, and is not required to safely shut down the plant.

A temporary supplemental steam tunnel cooling system can be installed and operated as needed to assist the STCS for maintaining steam tunnel ambient temperatures.

System Boundary

System components subject to aging management review are limited to fire dampers, as shown on the LR boundary drawings.

Cooling water components are evaluated in the turbine building chilled water system (P46).

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

System fire dampers prevent the spread of fires. [10 CFR 54.4(a)(3) – FP]

Maintain the area ambient temperature.

Component Types Subject to Aging Management Review

Table 2.3.3-57 lists the component types that require aging management review and their intended functions.

Table 3.3.2-57, Auxiliary Systems – Steam Tunnel Cooling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-57
Steam Tunnel Cooling
Component Types Subject to Aging Management Review

Component Type	Intended function
Damper housing	Pressure boundary

References

UFSAR: 9.4.3.1.2, 9.4.3.2.2, Appendix 9A.4.8

License Renewal Drawings: 912-0625

2.3.3.58 Storm Drain and Sewer (P67)

System Description

Surface drainage is provided by a combination of overland drainage features and the site's nonsafety-related storm drain system. Three separate subsurface storm drainage systems (east, west and south system) assist in surface drainage. Site topography and the storm drain system are designed to reduce the effects of the local intense precipitation (LIP) flooding event. The LIP flooding model incorporates the plant roof and storm drain systems providing discharge analyses for these systems. The site surface drainage ability is largely influenced by site topography and ground cover type; location and dimensions of above grade objects, structures and buildings; roof drainage and storage; surface drainage features; and subsurface storm drain systems.

The controlling flood hazard is the local intense precipitation (LIP) event.

The LIP domain comprises the site property bordered to the north by Lake Erie, to the east by the diversion stream and to the west and south by the major stream. All safety related buildings are located within the LIP domain.

Except for the roofs of the service water pumphouse, the emergency service water pumphouse and the circulating water pumphouse, the roofs of all buildings are drained to the storm drain system which discharges into the major and remnant minor streams that feed into Lake Erie. The roofs of the service water pumphouse, the emergency service water pumphouse and the circulating water pumphouse all drain to building wet wells.

In the event of the rupture or leakage of an onsite reservoir (e.g., cooling tower basins and industrial waste lagoons), the discharge will generally drain overland away from the plant into neighboring streams and thus to Lake Erie. The area surrounding the plant is also provided with a storm drain system which will collect surface water approaching the plant and assist in drainage of the power block area.

The flow from the south storm drain system discharges to the major stream and ultimately into Lake Erie. The flow from the east storm drain system discharges into the remnant minor stream which flows through the remnant minor stream culvert and ultimately into Lake Erie. The flow from the west storm drain system discharges at a topographic low point near the bluff and ultimately into Lake Erie.

Most of the storm drain conduit material is corrugated metal pipe (CMP) with a paved invert, and some small fraction of the conduit material is reinforced concrete pipe (RCP) as specified on the various drawings. There are also limited uses of polyvinyl chloride, cast iron, plastic pipe and high-density polyethylene in the storm drain system.

The storm drain system is nonsafety-related.

System Boundary

There are no mechanical system components subject to aging management review. The P67 storm drain and sewer system components are scoped under structural as water control structures. Building roof drains are evaluated under the P68 floor and equipment drains system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Collect and remove storm and flood water [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

None

Table 3.3.2-58, Auxiliary Systems – Storm Drain and Sewer System – Summary of Aging Management Evaluation, is included for completeness. There are no mechanical components in the scope of license renewal that are subject to aging management review.

References

UFSAR: Letter L-22-272, Attachment 2, proposed UFSAR text 2.4.2.2, 2.4.2.3, and 2.4.13.5.5.e

License Renewal Drawings: N/A

2.3.3.59 Suppression Pool Drain and Clean Up (G42)

System Description

The purpose of the suppression pool cleanup (SPCU) system is to maintain water purity and reduce activity levels in the suppression pool.

The system uses a mixed bed non-regenerative demineralizer. The main benefit of the system is to significantly reduce operator exposure to radioiodides which would evolve relatively slowly from the pool after depressurization of the reactor to the suppression pool. The system also provides a means for draining the suppression pool when necessary.

System Boundary

System components subject to aging management review include a pump, valves and associated piping components within the auxiliary building and the intermediate building that support cleanup of the suppression pool, as shown on the LR boundary drawing.

The system components in the radwaste building are not in scope because they are nonsafety-related and do not perform a License Renewal intended function.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

System pressure boundary supports ESF system operation and limits radiological release. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Component Types Subject to Aging Management Review

Table 2.3.3-59 lists the component types that require aging management review and their intended functions.

Table 3.3.2-59, Auxiliary Systems – Suppression Pool Drain and Clean Up System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-59
Suppression Pool Drain and Clean Up
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Orifice	Leakage boundary
Piping	Leakage boundary, Pressure boundary
Pump casing	Leakage boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 12.3.1.2

License Renewal Drawings: 302-0681

2.3.3.60 Suppression Pool Makeup (G43)

System Description

Following a LOCA, the suppression pool makeup system provides water from the upper containment pool to the suppression pool by gravity flow. The quantity of water provided is sufficient to account for all conceivable post-accident entrapment volumes (i.e., places where water can be stored while maintaining long term drywell vent water coverage).

The piping system consists of two lines which penetrate the separator storage section of the upper containment pool through the side walls. One line is located on either side of the separator pool. From there, each line is routed down to the suppression pool on opposite sides of the steam tunnel.

The volume of water available to dump from the upper containment pool, when combined with the suppression pool, is adequate to supply all post-accident entrapment volumes and keep the suppression pool at an acceptable level (2 feet above the top of the horizontal drywell vents) to condense steam exiting the vents, and to ensure continuous coverage of the RHR A/B test return line post-accident.

The system gravity dump time through one of the two redundant lines is less than or equal to the minimum pump time; pump time is determined by dividing pumping volume (upper pool makeup volume plus volume in the suppression pool stored between LLWL and minimum top vent coverage) by the total maximum runout flow rate from all five ECCS pumps.

System Boundary

System components subject to aging management review include valves and piping components that support gravity transfer of water from the upper pools to the suppression pool, as well as valves and piping components that penetrate containment to support instrumentation, as shown on the LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ and SBO.

Timely transfer of upper pool water to suppression pool for accident mitigation. [10 CFR 54.4(a)(1)]

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The upper containment pools are dumped during SBO to moderate suppression pool temperature. [10 CFR 54.4(a)(3) – SBO]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Transfer of upper pool water to suppression pool to support refueling activities.

Component Types Subject to Aging Management Review

Table 2.3.3-60 lists the component types that require aging management review and their intended functions.

Table 3.3.2-60, Auxiliary Systems – Suppression Pool Makeup System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-60
Suppression Pool Makeup
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure boundary
Piping	Pressure boundary
Valve body	Pressure boundary

References

UFSAR: 6.2.7, 6.2.7.1, 6.2.7.2, Appendix 15H.2.2

License Renewal Drawings: 302-0686

2.3.3.61 Turbine Building Chilled Water (P46)

System Description

The turbine building chilled water system operates continuously, as required, during normal operation to provide chilled water to the chilled water coils of various air handling units for the purpose of cooling the air supplied to the areas served by these air handling units.

Two 100 percent capacity water chilling machines and two 100 percent capacity chilled water recirculating pumps are provided. One set of chiller and pump are normally operated with the other set as backup. During operation, condenser water is provided by the nuclear closed cooling system. This system is not required to operate during a LOCA or loss of offsite power and is normally not required to operate during the winter season.

Initial fill and makeup water for this system is supplied by the two bed water distribution system. An open-type expansion tank (130 gallons flooded) and a chemical addition tank are provided.

The turbine building chilled water system is not safety-related and is not required to operate to safely shut down the plant following a design basis accident.

System Boundary

System components subject to aging management review include the pumps, chillers, heat exchangers, valves, and various piping components as shown on the LR boundary drawings.

Tubes within ventilation cooling units are within scope for leakage boundary, but tubes within closed systems such as chiller units do not perform a leakage boundary function – leakage from these tubes would require system repairs but would not result in external leakage that could impact a safety function.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Provide chilled water to the turbine building air handling units (turbine building ventilation system), turbine power complex air handling unit (turbine power complex ventilation system), turbine plant sample panel (turbine plant sampling system), and the steam tunnel air handling unit (steam tunnel cooling system).

Component Types Subject to Aging Management Review

Table 2.3.3-61 lists the component types that require aging management review and their intended functions.

Table 3.3.2-61, Auxiliary Systems – Turbine Building Chilled Water System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-61
Turbine Building Chilled Water
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Filter housing	Leakage boundary
Heat exchanger (Channel)	Leakage boundary
Heat exchanger (Shell)	Leakage boundary
Heat exchanger (Ventilation cooling header)	Leakage boundary
Heat exchanger (Ventilation cooling coil)	Leakage boundary
Orifice	Leakage boundary
Piping	Leakage boundary
Pump casing	Leakage boundary
Sight Glass	Leakage boundary
Sight Glass (Body)	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.4.9.2.2, 9.4.9.3

License Renewal Drawings: 913-0003, 913-0004

2.3.3.62 Turbine Building Closed Cooling (P44)

System Description

The turbine building closed cooling system consists of a closed-cycle network in which treated condensate-quality water is cooled with lake water in a heat exchanger and is circulated through the components being cooled. The system includes three half-capacity pumps, two full-capacity closed loop cooling heat exchangers, a system surge tank, a chemical treatment tank, and a piping network to circulate the cooling water through the components being cooled.

The three half-capacity pumps used for circulating cooling water in the system are of the single stage, horizontal, split-case centrifugal type. Two full-capacity heat exchangers are provided to cool the closed loop cooling water, one of which is normally in service. The heat exchangers are of the shell and tube type with lake water in the tubes and closed loop cooling water in the shell. A surge tank is provided to maintain the required pump suction head and to provide for system surge capacity. The tank is vented to atmosphere and is at the highest point in the system to ensure positive pressure in all system components. Level in the surge tank is maintained with a pneumatic level controller and a diaphragm operated makeup valve. A chemical treatment tank is provided for adding chemicals to the closed loop cooling water. The tank is connected to the suction and discharge of the closed loop cooling pumps in order to utilize the pump head for adding chemical to the system.

The turbine building closed cooling system is nonsafety-related and is not required for the safe shutdown of the reactor.

System Boundary

System components subject to aging management review are limited to the nonsafety-related piping components within the off-gas building, as shown on the LR boundary drawings. Additionally, System N64 (off gas) vault refrigeration heat exchangers are evaluated within this system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Provide cooling water for the removal of heat from various turbine plant components to support power production.

The integrity of nonsafety-related fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

Table 2.3.3-62 lists the component types that require aging management review and their intended functions.

Table 3.3.2-62, Auxiliary Systems – Turbine Building Closed Cooling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-62
Turbine Building Closed Cooling
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Heat exchanger (Channel)	Leakage boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.2.9.1, 9.2.9.2, 9.2.9.3

License Renewal Drawings: 302-0221

2.3.3.63 Turbine Building Ventilation (M35)

System Description

The supply units provide clean, filtered and cooled or heated air to the condenser bay area, condensate pump area, steam piping and valve area, turbine operating floor, condensate polishing area, and to the offgas building for the purpose of maintaining an ambient temperature suitable for operating plant equipment. Ducted exhaust air is provided at the roof of the turbine building. The supply air is drawn through the turbine operating floor, exhausted at the roof and discharged to the atmosphere by centrifugal fans through an elevated release point (heater bay vent duct). The supply system draws outside air, passes it through filters, heating coils and cooling coils (as required) and distributes the air to the condenser bay area, condensate pump area, steam piping and valve area, condensate polishing area, and to the offgas building. The air supply to the different areas in the turbine building is partly exhausted by the offgas building exhaust system, and the rest is drawn through the turbine operating floor by the turbine building/heater bay exhaust fans and discharged to the atmosphere through elevated release points.

The turbine building ventilation system is not required to operate during a LOCA or loss of offsite power. Components of this system are classified as nonsafety and non-seismic.

System Boundary

System components subject to aging management review are limited to fire dampers, as shown on the LR boundary drawing.

Fluid piping components associated with the supply of cooling and heating water are evaluated with the P46 turbine building chilled water and P55 building heating systems, and the plenum drain piping components are evaluated with the floor and equipment drains system.

Some of the dampers as shown on drawing 912-0614 are evaluated with the M36 offgas building ventilation system.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it is relied on to perform a function that demonstrates compliance with the regulations for FP.

System fire dampers prevent the spread of fires. [10 CFR 54.4(a)(3) – FP]

Turbine building ventilation provides cooled/heated air to turbine building areas, condensate polishing area, and off-gas building to maintain suitable ambient temperature.

Component Types Subject to Aging Management Review

Table 2.3.3-63 lists the component types that require aging management review and their intended functions.

Table 3.3.2-63, Auxiliary Systems – Turbine Building Ventilation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.3-63
Turbine Building Ventilation
Component Types Subject to Aging Management Review

Component Type	Intended function
Damper housing	Pressure boundary

References

UFSAR: 9.4.4.2.1, Appendix 9A.4.16.1

License Renewal Drawings: 912-0614

2.3.4 STEAM AND POWER CONVERSION SYSTEMS

The following systems are included in this section.

- Auxiliary Steam and Drains (Section 2.3.4.1)
- Condensate (Section 2.3.4.2)
- Condensate Transfer and Storage (Section 2.3.4.3)
- Control Rod Drive Rebuild Equipment (Section 2.3.4.4)
- Extraction Steam (Section 2.3.4.5)
- Feed Water Control, Feedwater and Feedwater Leakage Control (Section 2.3.4.6)
- Main Condenser (including the Main Turbine Shell) (2.3.4.7)
- Main and Reheat Steam (Section 2.3.4.8)
- Main, Reheat, Extraction, and Miscellaneous Drain (Section 2.3.4.9)
- Respirator Cleaning (Section 2.3.4.10)
- Service Water and Emergency Service Water Chlorination (Section 2.3.4.11)
- Two Bed Demineralizer and Distribution, and Mixed Bed Demineralizer and Distribution (Section 2.3.4.12)

2.3.4.1 Auxiliary Steam and Drains (P61)

System Description

Auxiliary steam is supplied by two packaged boilers fired with No. 2 fuel oil from the auxiliary boiler fuel oil system. Each boiler is capable of discharging 100,000 lb/hr of steam, at a drum pressure of 175 psig, through the auxiliary steam distribution header. Condensate from the auxiliary steam hot water heat exchangers and the drain pots on the distribution headers are returned to the common deaerator. Makeup water is supplied to the deaerator from the mixed bed demineralizer and distribution system.

The system can provide steam to the following components:

- Hot water heat exchangers (for building heating)
- Aux steam deaerator
- MSR blanketing
- Turbine steam sealing
- RCIC and reactor feed pump turbines (testing)

- Offgas preheater
- Steam jet air ejectors

System Boundary

System components subject to aging management review are limited to the nonsafety-related piping components within structures that contain safety-related components, as shown on the LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Provide steam to the building heating heat exchanger for area temperature control and condensate storage tank heating.

Provide steam supply to main turbine and reactor feed pump turbine steam seals during startup conditions and as a backup steam seal supply.

Component Types Subject to Aging Management Review

Table 2.3.4-1 lists the component types that require aging management review and their intended functions.

Table 3.4.2-1, Steam and Power Conversion Systems – Auxiliary Steam and Drains System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-1
Auxiliary Steam and Drains
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Piping	Leakage boundary
Strainer body	Leakage boundary
Trap body	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 9.5.10.2

License Renewal Drawings: 302-0052, 302-0053

2.3.4.2 Condensate (N21)

System Description

The condensate system transports condensate from the main condenser hotwell to the hot surge tank, maintaining proper water levels in the surge tank for all operating conditions. The condensate system provides the overall steam cycle water inventory required to accommodate reactor water level variations arising from load changes. The condensate system also serves as a cooling source for the offgas condenser, the steam jet air ejector condenser and the steam packing exhauster. The condensate system is also the water supply for the control rod drive system (C11).

The condensate system consists of three 50 percent motor-driven hotwell pumps, three 50 percent motor-driven condensate booster pumps, three stages of closed low pressure feedwater heaters, a direct contact heater and hot surge tank, and associated piping, valves and instrumentation. Feedwater heaters 1A, 1B, 1C, 2A, 2B, and 2C are located in the main condenser necks. Equipment interacting with, but not part of the condensate system includes the condensate cleanup system, the offgas condenser, the steam jet air ejector condensers, and the steam packing exhauster. The hotwell pumps take suction from the hotwell storage area below the IP condenser. The condensate is pumped through the condensate cleanup system, the offgas condenser, the steam jet air ejector condenser, and the steam packing exhauster, providing sufficient NPSH for the condensate booster pumps during all operating conditions. The hotwell pumps are the vertical-can centrifugal type. The condensate booster pumps are designed to pump condensate through three stages of closed low pressure feedwater heaters and into the direct contact heater. System flow requirements at the valves wide open (VWO) condition are met by two 50 percent capacity hotwell pumps and two 50 percent capacity booster pumps operating in series. The direct contact heater is of the horizontal spray type and is directly mounted on a horizontal hot surge tank. The direct contact heater and hot surge tank are designed in accordance with Section VIII, Division I of the ASME Code and meet the performance criteria of the Heat Exchange Institute (HEI) and ASTM D888-66. The low pressure feedwater heaters are shell and U-tube heat exchangers designed in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code.

System Boundary

System components subject to aging management review include nonsafety-related valves and piping components in the auxiliary and intermediate buildings, as depicted on LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The integrity of non-safety related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Transport condensate from the main condenser hotwell to the hot surge tank, maintaining proper water levels in the surge tank for all operating conditions.

Serve as a cooling source for the offgas condenser, the steam jet air ejector condenser and the steam packing exhauster.

Component Types Subject to Aging Management Review

Table 2.3.4-2 lists the component types that require aging management review and their intended functions.

Table 3.4.2-2, Steam and Power Conversion Systems – Condensate System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-2
Condensate
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Piping	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 10.4.7.1.1, 10.4.7.1.2

License Renewal Drawings: 302-0101

2.3.4.3 Condensate Transfer and Storage (P11)

System Description

The condensate transfer and storage system consists of one 500,000 gallon capacity storage tank with associated makeup and distribution systems. The tank is located outdoors adjacent to the turbine building.

A gravity header is provided to distribute water to the main condensers on a low water level signal in the condensers. On high water level in the main condensers, the condensate booster pumps discharge water back to the condensate storage tank through the same 12-inch line used for makeup. The gravity header also supplies water to the suction of three transfer pumps which provide pressurized water for the fuel pool cooling and cleanup system (FPCCS) filter backwash, the spent fuel pool, the radwaste system, the reactor water cleanup system, the refueling water (upper pool) system, and other miscellaneous uses that cannot be gravity fed.

A separate Safety Class 2, Seismic Category I header is provided near the bottom of the tank and sized to supply water simultaneously to the RCIC and HPCS systems. The alternate water supply to these systems for safe shutdown is the suppression pool.

A high level annunciator is provided to alert the operator of a potential tank overflow condition. A header is provided to return water from the RCIC and HPCS pumps during testing and from the control rod drive pumps during minimum recirculation.

The portion of the system between the containment isolation valves and the supply header to the RCIC and HPCS systems are Safety Class 2, Seismic Category I. The water contained in the storage tank will normally come in directly from the mixed bed water storage tank through the cycle. The cycle water will have passed through the condenser hotwell where it is held up for a minimum of two minutes for radioactive decay. To preclude an uncontrolled release of the content of the condensate storage tank, the tank is located within a concrete retaining structure designed to Seismic Category I requirements. This retaining structure is designed to accommodate the total liquid capacity of the condensate storage tank with at least one foot freeboard.

If water level in the condensate storage tank becomes low, RCIC and HPCS pump suctions are automatically transferred from the condensate storage tank to the suppression pool.

System Boundary

System components subject to aging management review include safety related valves and piping components associated with containment penetrations, piping /components and level sensing lines that supply water to the RCIC and HPCS systems, nonsafety-related piping and valves in areas containing safety-related components including HPCS, RCIC, and CRD return piping, and the condensate storage tank. Other piping attached to the condensate storage tank is included in scope up to the first isolation valve to provide an age-managed pressure boundary for the tank.

Insulation on CST level sensing instrumentation lines is addressed as part of structural scoping.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ and SBO.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1), (a)(3) - SBO]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Non-safety related piping up to and including the first equivalent anchor beyond safety/non-safety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

The system contains components within the scope of 10 CFR 50.49. [10 CFR 54.4(a)(3) – EQ]

Provide a minimum water storage capacity for the high pressure core spray System. [10 CFR 54.4(a)(3) – SBO]

Provide a minimum water storage capacity for the reactor core isolation cooling system.

Provide makeup to the main turbine cycle.

Store excess water returned from the main turbine cycle.

Component Types Subject to Aging Management Review

Table 2.3.4-3 lists the component types that require aging management review and their intended functions.

Table 3.4.2-3, Steam and Power Conversion Systems – Condensate Transfer and Storage System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-3
Condensate Transfer and Storage
Component Types Subject to Aging Management Review

Component Type	**Intended function**
Bolting	Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Tank	Pressure boundary
Valve body	Leakage boundary, Pressure boundary

References

UFSAR: 7.3.1, 7.4.1, 9.2.6.2, 9.2.6.3, Appendix 15H

License Renewal Drawings: 302-0102

2.3.4.4 Control Rod Drive Rebuild Equipment (L59)

System Description

The system provides a source of demineralized water and a tank for ultrasonic cleaning of control rod drive components.

System Boundary

System components subject to aging management review include tanks, filter housings, valves and piping components associated with support of control rod drive maintenance, as shown on the system boundary drawing. Pump casings, strainer body, and flexible hoses are made of polymers/elastomers and are not long-lived.

All components are nonsafety-related and are located in the control rod drive maintenance area on the 599 elevation of the intermediate building.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Provide demineralized, filtered water to support cleaning and maintenance of control rod drive equipment.

Component Types Subject to Aging Management Review

Table 2.3.4-4 lists the component types that require aging management review and their intended functions.

Table 3.4.2-4, Steam and Power Conversion Systems – Control Rod Drive Rebuild Equipment System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-4
Control Rod Drive Rebuild Equipment
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Filter housing	Leakage boundary
Piping	Leakage boundary
Pressure reducer	Leakage boundary
Tank	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: Table 12.3-16

License Renewal Drawings: 302-0008

2.3.4.5 Extraction Steam (N36)

System Description

The extraction steam system (N36) preheats feedwater through the use of excess steam that passes through the main turbine. The extracted steam is used as a heat source for feedwater heaters, first stage reheaters, the steam seal evaporator and the hot water heat exchanger.

High pressure feedwater heaters 5A(B) and 6A(B) receive extraction steam from the high pressure turbine. Low pressure feedwater heaters 1A(B,C), 2A(B,C), 3A(B) and direct contact heater number 4 receive extraction steam from the three low pressure turbines.

Extraction steam flows through the shell side of the heaters where it gives up heat to the condensate/feedwater flowing through the tubes, except for heater number 4 which is a direct contact heater.

The turbine maximum potential overspeed analysis assumes turbine load is suddenly reduced from maximum to zero, with no restraint of reverse flow in the extraction lines being considered, but all other turbine control and extraction non-return valves operate normally. This analysis demonstrates that these bottled-up volumes of steam and water within the turbine and extraction steam system will not cause the turbine speed to rise above a certain maximum value after a full load rejection or trip.

There are two steam sources for the building heating system (P55); the extraction steam system (N36), which is the normal source, and the auxiliary steam system (P61), which is the source during startup and shutdown.

System Boundary

System components within scope of license renewal are limited to nonsafety-related valves associated with limiting reverse steam flow from the first stage moisture separator reheaters, feedwater heaters 3, 5 and 6, the steam seal evaporator, and from the direct contact heater back to the turbine during an overspeed event. All these components are active and not subject to aging management review.

System Functions (and scoping criteria, if intended function)

The N36 extraction steam system does not contain any mechanical components that are safety-related or that are credited for regulated events. The N36 extraction steam system does contain mechanical components that are nonsafety-related whose failure could result in failure of a safety-related function. However, all those components are active and are not subject to aging management review. No N36 extraction steam system components perform a pressure boundary or leakage boundary intended function.

Limit extraction steam reverse flow to the turbine after a turbine trip to prevent a turbine overspeed event. [10 CFR 54.4(a)(2)]

Supply steam to the steam seal evaporator, moisture separator reheaters and feedwater heaters.

Extraction Steam supplies steam to the building heating heat exchanger.

Component Types Subject to Aging Management Review

None

Table 3.4.2-5, Steam and Power Conversion Systems – Extraction Steam System – Summary of Aging Management Evaluation, is included for completeness. There are no mechanical components in the scope of license renewal that are subject to aging management review.

References

UFSAR: 9.4.10.3, 10.2.2.1; 10.2.3

License Renewal Drawings: None

2.3.4.6 Feed Water Control (C34), Feedwater and Feedwater Leakage Control (N27)

System Description

The feedwater system is designed to pump condensate from the direct contact heater hot surge tank through two stages of feedwater heating to maintain the reactor vessel water level. Reactor feedwater flow is automatically controlled to maintain vessel water level within predetermined levels during all modes of plant operation.

The feedwater system is comprised of: four, one-third capacity motor-driven booster pumps, one stage of intermediate pressure heating with external drain cooler, two nominal half capacity horizontal reactor feedwater pumps with variable speed turbine drives, one 20 percent capacity motor-driven reactor feedwater pump, one stage of high pressure heating, valves, instrumentation and controls, and associated piping. Three booster pumps take water from the hot surge tank and discharge it through one stage of heating to the reactor feed pump suction. Both feed pumps discharge water through one stage of high pressure heaters into a mixing header before passing through two parallel feedwater shutoff valves to the reactor.

The feedwater leakage control (FWLC) system consists of two subsystems designed to eliminate through-line leakage in the feedwater piping by providing a positive seal for the stem, bonnet and seat of the outboard isolation valve on each line. The Division 2 subsystem uses the residual heat removal (RHR) waterleg pump and the Division 1 subsystem uses the low pressure core spray (LPCS) waterleg pump to supply sealing water through the bonnets of the MOVs. Following closure of the MOVs, the sealing water seals the stems, bonnets and seats, and isolates the feedwater lines.

The FWLC system will provide an adequate seal within approximately one hour following a LOCA. During this first hour, operation of the feedwater system will maintain a system pressure higher than the drywell pressure, thus ensuring water leakage into the vessel. Should the feedwater system become inoperable during the rapid vessel depressurization following a LOCA, the water in the feedwater piping will begin to flash into the drywell. It is expected that a water seal would remain for enough time following the accident until the operator remotely isolates the motor-operated valve. Thus, a water seal would exist in the piping beyond (outboard) of the motor-operated valve.

The feedwater control system controls the flow of feedwater into the reactor vessel to maintain the vessel water level within predetermined limits during all normal plant operating modes. The range of water level is based on the requirements of the steam separators (this includes limiting carryover, which affects turbine performance, and carryunder, which affects recirculation pump operation). The feedwater control system uses vessel water level, steam flow and feedwater flow as a three-element control. Single-element control is also available based on water level only. Normally, the signal from the feedwater flow is equal to the steam flow signal; thus, if a change in the steam flow occurs, the feedwater flow follows. The steam flow signal provides anticipation of the change in water level that will result from change in load. The level signal provides a correction for any mismatch between the steam and feedwater flow which causes the level of the water in the reactor vessel to rise or fall accordingly. The feedwater control system's functions are not considered essential for safety of the plant.

The shutdown sequence following a fire involves the use of the residual heat removal system in shutdown cooling mode. When the reactor reaches approximately 135 psig, the shutdown cooling mode of RHR A or RHR B would be initiated, at which time reactor water is pumped from one of the recirculation loops, through the RHR heat exchangers, then back to the reactor vessel by way of the feedwater system.

System Boundary

System components subject to aging management review include the piping components in the feedwater, feedwater control and feedwater leakage control systems as depicted on LR boundary drawings. The ASME Class 1 portions of the system are evaluated within the reactor coolant pressure boundary evaluation.

System Functions (and scoping criteria, if intended function)

The systems are within the scope of license renewal because they contain safety-related components that are relied upon to remain functional during or following a design basis event, because they contain nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because they are relied on to perform a function that demonstrates compliance with the regulations for FP, ATWS, and EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1)]

The system supports achieving safe shutdown. [10 CFR 54.4(a)(1), (a)(3) – FP]

Feedwater leakage control provides a water seal with the LPCS/RHR A or RHR B/C water-leg pump on the feedwater motor operated valve bonnets and internal seating volumes to maintain containment integrity during LOCA conditions. [10 CFR 54.4(a)(1)]

Post-LOCA, the feedwater system will maintain a system pressure higher than the drywell pressure. [10 CFR 54.4(a)(2)]

The system contains safety-related instrumentation. [10 CFR 54.4(a)(1), (a)(3) – EQ]

Feedwater flow is limited upon receipt of a high pressure signal and confirmed failures to scram from the RRCS logic, thereby reducing power and steam discharge to the suppression pool without operator action. [10 CFR 54.4(a)(3) – ATWS]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Supply feedwater to the reactor vessel for power conversion and reactor heat removal.

The feedwater system may be used for reactor water level control during ATWS mitigation.

Component Types Subject to Aging Management Review

Table 2.3.4-6 lists the component types that require aging management review and their intended functions.

Table 3.4.2-6, Steam and Power Conversion Systems - Feed Water Control, Feedwater and Feedwater Leakage Control – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-6
Feed Water Control, Feedwater and Feedwater Leakage Control
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary, Structural Integrity
Flow element	Structural Integrity
Piping	Leakage boundary, Pressure boundary, Structural Integrity
Thermal sleeve	Pressure boundary
Valve body	Pressure boundary, Structural Integrity
Heater	Pressure boundary
Cooler	Pressure boundary
Pump casing	Pressure boundary
Strainer	Pressure boundary
Orifice	Pressure boundary

References

UFSAR: Table 3.6-3, 6.9.2, 7.7.1.4., 10.4.7.2.1, 10.4.7.2.3, Appendix 9A.3.1

License Renewal Drawings: 302-0081, 302-0082, 302-0971

2.3.4.7 Main Condenser and Auxiliaries (N61)

System Description

The main condenser is a three shell, three pressure type with a rubber expansion joint in each neck. Differential water levels are maintained in each of the three condenser hotwells allowing condensate to flow from the lowest pressure to the intermediate pressure, then to the highest pressure hotwell where it is reheated. From there it flows to the hotwell storage located under the intermediate pressure condenser. This hotwell is an extension of the high pressure condenser hotwell and is connected to it by a cross-under pipe. The hotwell storage is isolated from the IP condenser by a solid divider plate and is vented to the HP condenser. Condensate leaves the hotwell through two outlets. During normal operation the main condenser receives the following flows:

a. Main turbine exhaust steam.

b. Auxiliary condenser condensate.

c. Drains from low pressure heater No. 1.

d. Steam packing exhauster drains.

e. Steam jet air ejector (SJAE) condenser drains.

f. Offgas condenser drains.

g. Feedwater heater vents.

h. Turbine governor valve leakoffs.

i. Seal steam header flow.

j. Feed pump seal leakoff.

k. Main, reheat, extraction, and miscellaneous drains.

The main condensers are not required to affect or support the safe shutdown of the reactor, or to support in the operation of reactor safety features.

The radiological consequences for the most limiting case of a control rod drop accident occurs as the result of a release to the environment due to the condenser leakage, following closure of the main steam isolation valves. Of the activity reaching the condenser, 100 percent of the noble gases, 10 percent of the iodines, and 1 percent of the particulate radionuclides (due to partitioning and plateout) remain airborne. The activity airborne in the condenser is assumed to leak directly to the environment at a rate of 1.0 percent per day, for a period of 24 hours.

System Boundary

System components subject to aging management review include the external shell for the main condenser (including interconnecting vent and air removal lines), the N31 system turbine casing, and condenser tubesheet.

The air removal lines and N62 condenser air removal system components are shown on drawing 302-0131. These components are evaluated under N61 main condenser system and illustrated on the scoping drawing 302 0103.

Interfacing systems such as Main Steam (N11) and Extraction Steam (N36) are evaluated separately.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Provide hold up volume for radioactive decay, and limit leakage to the environment for 24 hours following a control rod drop accident. [10 CFR 54.4(a)(2)]

Condense steam from the main turbine and/or steam bypass and pressure regulating system for power conversion; and for reactor heat removal.

Collect miscellaneous turbine plant condensate, leakoff, vents, and drain flows.

Component Types Subject to Aging Management Review

Table 2.3.4-7 lists the component types that require aging management review and their intended functions.

Table 3.4.2-7, Steam and Power Conversion Systems - Main Condenser and Auxiliaries – System Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-7
Main Condenser and Auxiliaries
Component Types Subject to Aging Management Review

Component Type	Intended function
Bellows (Air Removal Pipe Connection)	Pressure boundary
Bolting	Pressure boundary
Condenser (Tubesheet)	Structural support
Condenser manway cover	Pressure boundary
Condenser Shell	Pressure boundary
Piping	Pressure boundary

Component Type	Intended function
Rupture disc	Pressure boundary
Turbine Casing	Pressure Boundary

References

UFSAR: 10.4.1.3, 10.4.1.4. 15.4.9.5.1

License Renewal Drawings: 302-0103

2.3.4.8 Main and Reheat Steam (N11)

System Description

The main steam piping consists of four 28-inch O.D. lines from the outer containment isolation valves to the main turbine stop valves, and connecting lines to supply steam to the second stage reheater, the condenser steam jet ejectors, offgas preheaters, the main turbine bypass valves, the reactor feed pump turbines, and the seal steam evaporator. All piping in the system is carbon steel.

Pipe restraints are provided to protect safety-related piping and valves from the effects of pipe rupture from any cause. A moment resisting pipe restraint system is provided for both the main steam and feedwater system. The system consists of two restraint locations for each system to provide a couple type moment resistance. Both restraint locations are in the safety-related portion of the steam tunnel in the auxiliary building. One of the two restraints is located adjacent to the point at which the classification of the steam tunnel changes. Therefore, effects of pipe rupture downstream of the motor-operated stop valves will not be transmitted to the isolation valves.

A reliable, redundant, fail-safe turbine overspeed system is incorporated for the safety of plant personnel and equipment, and to ensure no mitigation of engineered safety systems employed for safe, orderly shutdown of the reactor system. In the event of a turbine overspeed condition, the overspeed trip system releases the fluid pressure on the disk dump valves for main stop and control valves and intermediate stop and intercept valves, thereby closing the turbine steam valves. In addition to overspeed trip signals, the emergency trip system closes the main stop and control valves, and the intermediate stop and intercept valves, thereby shutting down the turbine on the trip signals due to mechanical faults and generator electrical faults.

Two separate radiological analyses are provided for the control rod drop accident (CRDA):

1. The first analysis assumes the accident occurs at a low reactor power level with the mechanical vacuum pumps in operation or at any power level with a coincident loss of offsite power (LOOP);

2. The second analysis assumes the accident occurs at a higher reactor power level with the steam jet air ejectors in operation such that the condenser gases are processed through the offgas filtration system.

For the first CRDA scenario:

A coincident LOOP condition results in the automatic closure of the MSIVs, thereby stopping the transport of the fission products to the condenser. Radioactive release to the environment follows due to the condenser leakage.

For the second CRDA scenario:

The transport pathway consists of carryover with steam to the turbine condenser and leakage from the condenser to the environment via the offgas (N64) system.

System Boundary

System components subject to aging management review include safety related valves and piping components from the main steam line outside containment isolation valves, up to and including the main steam shutoff valves in the steam tunnel, and the connected nonsafety-related piping within the steam tunnel and the piping necessary to encompass the equivalent anchors beyond the safety class boundary, as shown on LR boundary drawings.

Based on the results of Calculation 3.2.15.2.1, Rev. 1, and the NRC Safety Evaluation for PNPP License Amendment 166, the second CRDA scenario that credits steam flow from the Reactor to the Condenser and eventual release to the environment through the N62 air removal and N64 off gas systems is not used as a basis for acceptance for PNPP CRDA radiological consequences. Ultimately, the N11 main and reheat system has no effect on the radiological consequences of a control rod drop accident, and as such does not meet 54.4(a) scoping criteria for mitigation of a CRDA.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Limiting steam flow to the turbine after a turbine trip to prevent a turbine overspeed event is an active function, relying on valves to reposition to stop or divert steam flow to the turbine. The passive pressure boundary function is not credited, as leakage of steam to the environment serves to mitigate the event. No mechanical components are subject to aging management to support this function.

To prevent a failure that could lead to the release of radioactivity, the main steam system is designed to accommodate the most severe conditions of coincident pressure, temperature and loading, including operational basis and safe shutdown earthquake conditions and protection from postulated external phenomena. [10 CFR 54.4(a)(1)]

The integrity of non-safety related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Non-safety related piping up to and including the first equivalent anchor beyond safety/non-safety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Limit steam flow to the turbine after a turbine trip to prevent a turbine overspeed event [10 CFR 54.4(a)(2)]

The system contains components credited with compliance with 10 CFR 50.49. [10 CFR 54.4(a)(3) EQ]

Supply steam to the main turbine for power conversion and reactor heat removal.

Supply steam to Reactor Feed Pump Turbines and Moisture Separator Reheaters for feedwater supply and thermal performance.

Component Types Subject to Aging Management Review

Table 2.3.4-8 lists the component types that require aging management review and their intended functions.

Table 3.4.2-8, Steam and Power Conversion Systems - Main and Reheat Steam – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-8
Main and Reheat Steam
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Pressure Boundary
Piping	Leakage Boundary, Pressure Boundary, Structural Integrity
Valve body	Pressure boundary

References

UFSAR: 3.2.3.2, 10.3.2, 10.3.3

License Renewal Drawings: 302-0011, 302-0605

2.3.4.9 Main, Reheat, Extraction, and Miscellaneous Drains (N22)

System Description

The main, reheat, extraction, and miscellaneous drains system consists of drains located at low points and pockets in the steam piping system before and after seats of various valves, valve stem leak offs, and equipment shell drains and vents. Many of these drain lines contain valves, strainers and restricting orifices to ensure proper drainage and water removal from system piping during system warm up, startup, and normal load operations.

System Boundary

System components subject to aging management review include safety-related valves and piping, and nonsafety-related piping components in the steam tunnel, as depicted on LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, and because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

Provide safety-related piping integrity. [10 CFR 54.4(a)(1)]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Remove condensed steam from the various steam lines and components and direct it to the main condenser.

Component Types Subject to Aging Management Review

Table 2.3.4-9 lists the component types that require aging management review and their intended functions.

Table 3.4.2-9, Steam and Power Conversion Systems – Main, Reheat, Extraction, and Miscellaneous Drains System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-9
Main, Reheat, Extraction, and Miscellaneous Drains
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Valve body	Pressure boundary

References

UFSAR: N/A

License Renewal Drawings: 302-0121

2.3.4.10 Respirator Cleaning (L58)

System Description

Respirator cleaning equipment is provided to support cleaning and maintenance of respiratory protection equipment.

System Boundary

System components subject to aging management review include piping components used to support respirator cleaning as depicted on the LR boundary drawing.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Provide demineralized water to support cleaning and maintenance of respiratory protection equipment.

Component Types Subject to Aging Management Review

Table 2.3.4-10 lists the component types that require aging management review and their intended functions.

Table 3.4.2-10, Steam and Power Conversion Systems - Respirator Cleaning – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-10
Respirator Cleaning
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Piping	Leakage boundary
Tank (Air hood sink)	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 12.5.2.1

License Renewal Drawings: 302-0714

2.3.4.11 Service Water and Emergency Service Water Chlorination (P48)

System Description

The service water and emergency service water chlorination system is a liquid biocide injection system which is used, as required, to minimize algae and plant growth. Sodium hypo-chlorite, rather than chlorine, is used as a biocide. This is done on a regular basis at each individual pump suction. Sample points are provided in the discharge piping to determine biocide concentrations. Discharged effluent water quality will be maintained in accordance with PNPP's National Pollution Discharge Elimination System (NPDES) permit.

System Boundary

System components subject to aging management review are limited to nonsafety-related piping components within the emergency service water pumphouse as listed on the LR boundary drawings.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function.

The integrity of non-safety related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Minimize algae and plant growth within the emergency service water and service water systems.

Component Types Subject to Aging Management Review

Table 2.3.4-11 lists the component types that require aging management review and their intended functions.

Table 3.4.2-11, Steam and Power Conversion Systems - Service Water and Emergency Service Water Chlorination – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-11
Service Water and Emergency Service Water Chlorination
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary
Piping	Leakage boundary
Sight glass	Leakage boundary
Sight glass (body)	Leakage boundary
Strainer body	Leakage boundary
Valve body	Leakage boundary

References

UFSAR: 6.4.4.2, 9.2.1.2, 9.2.7.2

License Renewal Drawings: 302-0215

2.3.4.12 Two Bed Demineralizer and Distribution (P21), and Mixed Bed Demineralizer and Distribution (P22)

System Description

The primary water source for the demineralized water makeup system is raw Lake Erie water supplied by the service water system. The Lake Erie water is pretreated and transferred to a clearwell (makeup water pretreatment system). Part of the clearwell water is used for miscellaneous services and the remainder is used for plant makeup to the demineralizers.

The demineralizer system is not safety-related. The system is designed to produce sufficient water to meet plant makeup requirements. The demineralized water is used to supply miscellaneous services and makeup to the condenser, or alternatively, the condensate storage tank.

The portion of the demineralizer system consists of a vendor-owned and operated water treatment skid. This water treatment skid produces demineralized water for plant use. The effluent of the vendor water treatment skid supplies both the two-bed and mixed bed water storage tanks. Two-bed and mixed bed storage tank water is distributed to various plant locations via the associated distribution pumps and piping.

System Boundary

System components subject to aging management review include safety-related piping and valves associated with containment/drywell penetrations and the water fill for the containment vessel and drywell purge system penetrations, and nonsafety-related valves, piping components and appliances located in areas containing safety-related components.

System Functions (and scoping criteria, if intended function)

The system is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event, because it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and because it is relied on to perform a function that demonstrates compliance with the regulations for EQ.

Containment isolation limits radiological release. [10 CFR 54.4(a)(1), (a)(3) – EQ]

Drywell isolation valves ensure drywell boundary by minimizing potential paths to the environment and ensure drywell pressure suppression capability. [10 CFR 54.4(a)(1), (a)(3) – EQ]

The integrity of nonsafety-related, fluid-retaining components in safety-related area(s) prevents interactions that could affect safety-related SSCs. [10 CFR 54.4(a)(2)]

Nonsafety-related piping up to and including the first equivalent anchor beyond safety/nonsafety interface(s) provides mechanical support for safety-related SSCs. [10 CFR 54.4(a)(2)]

Store and supply demineralized water to the main condenser and miscellaneous services.

Component Types Subject to Aging Management Review

Table 2.3.4-12 lists the component types that require aging management review and their intended functions.

Table 3.4.2-12, Steam and Power Conversion Systems – Two Bed Demineralizer and Distribution, and Mixed Bed Demineralizer and Distribution System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.3.4-12
Two Bed Demineralizer and Distribution, and
Mixed Bed Demineralizer and Distribution
Component Types Subject to Aging Management Review

Component Type	Intended function
Bolting	Leakage boundary, Pressure boundary
Piping	Leakage boundary, Pressure boundary
Sink	Leakage boundary
Valve body	Leakage boundary, Pressure boundary
Water heater	Leakage boundary

References

UFSAR: 9.2.3

License Renewal Drawings: 302-0711, 302-0712, 302-0713

2.4 SCOPING AND SCREENING RESULTS: STRUCTURES

The following structures and structural components are within the scope of license renewal:

- Containment structure, (reactor building complex), Unit 1 (Section 2.4.1)
- Turbine buildings and associated structures, process facilities, yard structures and unit 2 structures (Section 2.4.2)
- Water control structures (Section 2.4.3)
- Structural bulk commodities (Section 2.4.4)

Specifically, this section provides the following information for the Perry structures within the scope of license renewal listed in Table 2.2-2:

1. The description;
2. A list of license renewal intended functions, including which criteria of 10 CFR 54 [Reference 1.3-1] require the structure to be in-scope;
3. Reference to the applicable Perry UFSAR [Reference 1.3-6] section(s);
4. Reference to the applicable license renewal boundary drawing(s); and,
5. A list of component types that are subject to an aging management review with their associated component intended function(s).

Table 2.4-1 provides a list of the abbreviations and definitions for the intended functions assigned in the following sections.

Note: Structural bulk commodities located within all the in-scope structures are described in Section 2.4.4.

Table 2.4-1
Intended Functions: Abbreviations and Definitions

Intended Function	Abbreviation	Definition
Absorb Neutrons	ABN	Provide neutron absorption (e.g., neutron absorbers in spent fuel pool storage racks)
Direct Flow	DF	Provide spray shield or curbs for directing flow (e.g., safety injection flow to the suppression pool)
Expansion or Separation	EXP	Provide for thermal expansion or seismic separation
Fire Barrier	FB	Provide rated fire barrier to confine or retard a fire from spreading to or from adjacent areas
Flood Barrier, including Temporary Flood Barrier	FLB	Provide flood protection barrier (internal and external flooding event)
Gaseous Release Path	RP	Provide path for release of filtered and unfiltered gaseous discharge
Heat Sink	HS	Provide heat sink during SBO or design basis accidents
HELB Shielding	HELB	Provide shielding against high energy line breaks (HELB)
Missile Barrier	MB	Provide missile barrier (internally or externally generated)
Pipe Whip Restraint	PW	Restrain piping motion related to HELB
Pressure Relief	PR	Provide over-pressure protection
Shelter or Protection	EN	Provide shelter or protection to safety-related equipment (includes HELB, radiation shielding)
Shielding	SHD	Provide radiation shielding to reduce neutron or gamma radiation fluence
Structural Pressure Boundary	SPB	Provide pressure boundary or essentially leak tight barrier to protect public health and safety in the event of postulated design basis events. Limit radiological exposures as result of accidents comparable to those referred to in 10CFR50.67.
Support for Criterion (a)(1) Equipment	SSR	Provide structural or functional support to safety-related equipment

Intended Function	Abbreviation	Definition
Support for Criterion (a)(2) Equipment	SNS	Provide structural or functional support to nonsafety-related equipment whose failure could prevent satisfactory accomplishment of required safety functions (includes Seismic II over I considerations)
Support for Criterion (a)(3) Equipment	SRE	Provide structural or functional support required to meet the Commission's regulations for the regulated events in 10 CFR 54.4(a)(3)

2.4.1 CONTAINMENT STRUCTURE, UNIT 1 (REACTOR BUILDING COMPLEX)

Description

Containment Structure (Reactor Building Complex)

The reactor building complex consists of the interior structure (including drywell and suppression pool), containment vessel, annulus concrete, and shield building. These structures house and protect the reactor and some safety class equipment, and the structures are supported by a common foundation mat at elevation 574'-10". The interior structure is separate from the containment vessel, annulus concrete and shield building above the mat, however the containment vessel and shield building are tied together by the annulus concrete, to elevation 598'-4".

The purpose of the Unit 1 Mark III containment structure is to serve both as a biological shield and as a pressure suppression containment during loss-of-coolant accidents (resulting from the spectrum of postulated piping breaks within the reactor coolant pressure boundary). The containment structure is comprised of a free standing steel containment vessel and annulus concrete acting compositely. The shield building forms a housing for the steel containment, and concrete is added in the annulus between the containment vessel and the shield building, which strengthens and stiffens the containment vessel. The leak tight containment vessel surrounds the drywell and the suppression pool. The drywell encloses the reactor pressure vessel, the reactor coolant recirculation loops and pumps, and other branch connections of the reactor primary system.

The containment structure as well as all penetrations and the interior structures are seismic Category I structures. The primary containment and secondary containment, in conjunction with other engineered safety features, limit radiological effects of accidents resulting in the release of radioactive material to the containment volumes to less than the prescribed acceptable limits.

The structures of the containment structure are addressed individually, below.

Shield Building and Annulus Concrete

The shield building has the following functions:

- Forms a biological shield for radiation from the reactor.
- Provides protection for the containment vessel from ground water contact and pressure.
- Provides weather and exterior missile protection for the containment vessel.

- Provides a relatively leak tight structure to act as a secondary containment so that the annulus exhaust gas treatment system can be used to minimize the escape of fission products to the environment.

The shield building is a reinforced concrete structure consisting of a flat foundation mat, a cylindrical wall and a shallow dome. The foundation mat, common to the shield building, annulus concrete, containment vessel, and interior structure is circular with a diameter of 136 feet and a thickness of 12 feet 6 inches. The foundation mat is founded on Chagrin shale.

The shield building cylindrical wall extends from the top of the foundation mat at elevation 574’-10” to elevation 749’-9”. The shield building is a cylindrical reinforced concrete structure with a spherical dome enclosing the containment vessel. The internal diameter is 130 feet and the outside diameter is 136 feet. The shield building dome has a thickness of 2 feet 6 inches. There is no thickened ring girder, but the elevation of the wall at the junction of the wall and dome was raised to provide a greater section to help resist the outward thrust of the dome.

A 12-inch thick layer of porous concrete and a 4-inch thick concrete mud mat form a supporting medium between the bottom of the foundation mat and the Chagrin shale. The porous concrete is part of the plant foundation underdrain system (Section 2.3.3.44) that is used to reduce the hydrostatic pressure acting on plant structures. Adjacent safety class structures are separated by enough space (rattle space) to accommodate seismic movements. The walls of adjacent safety class structures are designed for water elevation at 590 feet, corresponding to the design basis groundwater elevation.

Access to the inside of the containment vessel though the shield building is provided by two personnel airlocks. The airlocks use inflatable seals to maintain the containment pressure boundary. The inflatable seals are short-lived and are periodically replaced.

A separate shield building equipment hatch allows for access from the fuel handling building during outages. This octagonal opening in the shield building is 20 feet across the flats. The opening is shielded by removable reinforced concrete beams which are provided with seals to minimize the leakage of air.

The design of mechanical and electrical penetration sleeves and bellows allows differential movement between the shield building and the containment vessel. The annulus concrete extends from the top of the foundation mat to elevation 598 feet 4 inches and has a radial thickness of 4 feet 10.5 inches. The annulus concrete provides stiffness to the steel containment vessel to reduce the dynamic response of the steel containment vessel due to the postulated safety/relief valve discharge loading phenomena. The containment vessel is also structurally strengthened by the annulus concrete.

The space between the shield building and the containment vessel largely comprises secondary containment. The shield building is designed to collect the fission product leakage from the primary containment during and following a postulated design basis LOCA and delay it until it can be released to the environs after processing through the annulus exhaust gas treatment system such that the resultant offsite doses are less than the values set forth in 10 CFR 50.67 [Reference 1.3-7].

Containment Vessel

A leak-tight containment vessel surrounds the drywell and the suppression pool. The steel containment vessel is designed, fabricated and erected in accordance with the requirements of ASME Code Section III for Class MC components. The containment vessel is a pressure-retaining structure composed of a free-standing steel cylinder with an ellipsoidal dome, secured to a steel-lined, reinforced concrete foundation mat. The mat is the common foundation for the three major structures of the reactor building complex. The free-standing portion of the containment vessel is supported by and anchored into the foundation mat.

The basic dimensions of the containment vessel are:

a. cylinder inside diameter - 120 feet.

b. cylinder height - 152 feet - 2 inches.

c. ellipsoidal dome ratio - 2:1.

The containment vessel cylinder has six external stiffening rings at various elevations. Two personnel access airlocks and one equipment hatch are provided. The lower 18 feet 6 inches of the containment vessel forms the outside of the suppression pool. Corrosion of the lower 23 feet 6 inches of the containment vessel and exposed steel mat liner is minimized using stainless steel clad.

Final design plate thickness of the containment vessel cylinder and dome is 1-1/2 inches. This is increased to three-inch thick plate around the penetrations in the Suppression Pool region to provide local reinforcement for containment vessel pressure loads as well as penetration loads. Base liner plates are 3/8-inch thick carbon steel where they are covered by concrete, and 1/2-inch thick stainless clad where they are exposed to the suppression pool water.

Steel test channels are provided along welds of the steel liner of the foundation mat so that local leak testing of welds can be performed.

Missile protection is provided within the containment for internally generated missiles, such as from rotating equipment or pressurized component failure.

No fuel is stored in the containment upper pool during plant operation. The aluminum spent fuel storage racks in the containment upper pool achieve subcriticality by spacing in a loose packed geometric array.

The containment polar crane is designed to Seismic Category I requirements. The crane consists of two crane girders and a trolley. The circular runway (rails) which supports the crane girders is supported from the containment vessel.

The pressure suppression containment system is designed to have the following functional capabilities:

- The containment and drywell have the capability to maintain functional integrity during and following peak transient pressures and temperatures which would occur following any postulated loss-of-coolant accident (LOCA).
- The containment, in combination with other accident mitigation systems, limits fission product leakage during and following the postulated design basis accident to values less than leakage rates that would result in offsite doses greater than those stated in 10 CFR 50.67 [Reference 1.3-7].
- The containment system provides means to channel the flow from postulated pipe ruptures in the drywell to the suppression pool.

<u>Drywell</u>

The drywell encloses the reactor pressure vessel, the reactor coolant recirculation loops and pumps, and other branch connection of the reactor primary system. The drywell is a cylindrical reinforced concrete structure with a removable steel head. The drywell is subdivided into two regions. The lower 26 feet 2 inches of the drywell is the vent region. The main suppression pool area in the containment vessel is connected to the drywell by vents. The vent structure consists of two concentric one-inch thick steel cylinders with a ten percent stainless steel cladding. The annulus between the cylinders is stiffened vertically by radial steel plates and is filled with concrete. The vent sleeves are 28 inch outside diameter, 1/4-inch thick, stainless steel tubes located in 3 rows of 40 vents.

The vent region is anchored to the containment base mat. The upper drywell wall region is a reinforced concrete cylinder connected to the lower vent region by cadwelding all vertical and diagonal rebars to the ring girder. The upper drywell wall extends up to the drywell top slab. Above the vent region, the inside face of the drywell is formed with a steel plate. The drywell top slab is a flat, horizontal, circular, reinforced concrete slab. It contains a central circular opening which is closed by the drywell head. The entire drywell cylindrical wall is recessed into the reactor building foundation and provides a continuous shear key for resisting radial/transverse shear forces by direct bearing of the drywell wall base on the foundation mat.

Penetrations through the drywell wall for piping and electrical systems are of the single barrier leak tight type. The main steam lines are anchored at the drywell and are provided with guard pipes through to the isolation valves outside containment. All such guard pipes vent to the drywell. A personnel airlock provides access to the drywell. The personnel access air lock has an outside diameter of 9 feet 8 inches and is located at the 599’-9” elevation floor to provide access to the drywell. For large pieces of equipment, a bolted, double gasket sealed, equipment access hatch is provided.

The foundation mat provides support for the reactor pressure vessel (RPV) pedestal. This support is a concrete filled, double steel walled cylinder, located directly beneath the RPV and the biological shield wall. A support structure for the control rod drive mechanisms is located inside of the inner shell of the pedestal. The RPV pedestal is anchored to the foundation mat. The RPV pedestal is haunched at the top to provide bearing area for the RPV sole plate. The RPV skirt is bolted to the RPV pedestal.

A 2-foot thick reinforced concrete biological shield wall surrounds the RPV and is supported on the RPV pedestal. The biological shield wall is a concrete-filled, double steel walled cylinder. The outside plates of the biological shield wall and the pedestal are continuous. This wall also supports a platform at elevation 599 feet, 9 inches, and provides missile protection. Flow diverters are fitted to the recirculation suction line penetrations so that the flow from a reactor pressure vessel safe end nozzle break is directed into the drywell volume with minimal pressurization of the annulus between the biological shield wall and the RPV.

Suppression Pool and Weir Wall

The drywell, suppression pool and the containment vessel are designed to condense the steam and contain fission product releases from the postulated design bases accident, i.e., the double-ended rupture of the largest pipe in the reactor coolant system. The suppression pool contains a large amount of water used to rapidly condense steam from reactor vessel blowdown or from a break in a major pipe. Part of the suppression pool water is inside the drywell (retained by a cylindrical concrete weir wall), but the major portion is outside the drywell between the drywell wall and the containment wall. The lower 18 feet, 6 inches of the containment vessel forms the outside of the suppression pool; the inside of the suppression pool is formed by the drywell weir wall. The weir wall is 24 feet, 2 inches high and 1 foot, 6 inches thick. The outer face of the weir wall is lined with stainless steel. The weir wall provides missile protection.

The suppression pool provides a water source for each of the emergency core cooling systems.

Refueling and Reactor Servicing Areas

Fuel assemblies are transferred through the transfer tube between the reactor building and the fuel handling building. The fuel assemblies inside the containment are handled by the refueling platform. The handling of the reactor head, removable internals and drywell head, during refueling, is accomplished using the containment polar crane.

The fuel storage and transfer pools are rectangular shaped compartmented structures, constructed of reinforced concrete lined with stainless steel. This structure is supported on the drywell and drywell top slab. The top slab is stiffened by two longitudinal reinforced concrete walls which are part of the upper pool wall system. The fuel transfer penetration connects the upper fuel pool above the drywell to the fuel handling building.

This penetration has a guard pipe and is inclined at an angle of 57 degrees to the horizontal.

The containment building is supplied with a refueling platform for fuel movement and servicing, and an auxiliary platform for servicing operations from the refueling floor level.

The refueling platform is a gantry crane which is used to transport fuel and reactor components to and from pool storage and the reactor vessel. The platform spans the fuel storage and vessel pools on embedded tracks in the refueling floor. A telescoping mast and grapple suspended from a trolley system is used to lift and orient fuel bundles for core, storage rack, or upender placement.

An auxiliary platform is provided to allow versatility of operations. This platform operates over the reactor building pool and provides an additional work area for reactor servicing. A half-ton design load capacity hoist is provided for reactor servicing tasks. The hoist is administratively limited to 500 pounds. The design of the auxiliary platform allows for concurrent reactor servicing with fuel movements by the refuel platform.

Functions (and scoping criteria, if intended function)

The containment structure is within the scope of license renewal because it contains safety-related related components that are relied upon to remain functional during or following a design basis event, and because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection, equipment qualification, anticipated transients without scram, and station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The containment structure has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1)]
- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), equipment qualification (10 CFR 50.49), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]
- Limits fission product leakage during and following the postulated design basis accident to values less than leakage rates that would result in offsite doses greater than those stated in 10 CFR 50.67. [10 CFR 54.4(a)(1)]
- Control the release of fission products to the secondary containment in the event of a design basis loss-of-coolant accident (LOCA) so that offsite consequences are within acceptable limits. [10 CFR 54.4(a)(1)]

- The containment and drywell have the capability to maintain functional integrity during and following peak transient pressures and temperatures which would occur following any postulated loss-of-coolant accident (LOCA). [10 CFR 54.4(a)(1)]
- The suppression pool provides a source of water for emergency core cooling systems. [10 CFR 54.4(a)(1)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]

Component Types Subject to Aging Management Review

Table 2.4.1-1 lists the component types that require aging management review and their intended functions.

Table 3.5.2-1, Structures – Containment Structure, Unit 1 – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.4.1-1
Containment Structure, Unit 1
Component Types Subject to Aging Management Review

Component Type	Intended function
Annulus and shield building cable supports	SNS, SSR, SRE
Beams, columns, floor slabs and interior walls	EN, FLB, MB, SRE, SSR, SHD
Beams, columns, floor slabs and interior walls (containment (drywell) (steam tunnel)	MB, SNS, SPB, SSR, SHD, EN, SRE
Beams, columns, floor slabs and interior walls (annulus concrete)	SSR
Bolting	SPB, SSR
Containment auxiliary platform equipment assembly and rails	SNS
Containment base slab	FLB, SNS, SPB, SRE, SSR
Containment equipment hatch	EN, MB, SPB, SSR
Containment equipment hatch crane girders and rails	SNS
Containment foundation	SNS, SRE, SSR
Containment guard pipes	EN, MB, SPB, HELB
Containment monorails	SNS

Component Type	Intended function
Containment penetration bellows and welds	SPB, SSR
Containment personnel airlocks and seals	EN, SPB, SSR
Containment refueling platform and rails	SNS
Containment sump structures	SSR
Containment vessel	EN, MB, SNS, SPB, SSR
Containment vessel electrical penetrations	SNS, SPB, SRE, SSR
Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE
Drywell	EN, FB, MB, SPB, SSR, DF, RP, PR, SRE
Drywell electrical penetrations	EN, SPB, SSR, FB, SRE
Drywell equipment hatch and seals	EN, MB, SPB, SSR
Drywell floor slab	EN, SSR, SNS, SRE
Drywell head	EN, MB, SPB, SSR
Drywell liner plate	EN, MB, SPB, SSR
Drywell mechanical penetrations	EN, SPB, SSR, FB, SRE
Drywell personnel airlock	EN, SPB, SSR
Drywell wall vent structure	EN, MB, SPB, SSR
Drywell wall vents	SSR, PR, RP
Drywell weir wall	EN, MB, SPB, SSR
Fuel transfer tube penetration	SPB, SSR, FB
Grounding bar	EN, SNS, SPB, SSR
Polar crane and rails	SSR
Quencher supports	SSR
Reactor pedestal	SSR
Service level 1 coatings	SNS
Shield building cylinder wall and dome	EN, FB, FLB, MB, SNS, SPB, SRE, SSR, RP, SHD
Shield building electrical penetration seals and sealant	FB, SPB, SSR, SRE
Structural steel	EN, MB, SNS, SSR
Sump liners and penetrations	EN, SPB, SSR
Upper containment pool floor and walls	EN, MB, SNS, SPB, SSR

Component Type	Intended function
Upper containment pool gates and seals	EN, SPB

Note: Drywell radiant barrier (heat shield) is considered a bulk commodity and is addressed in the Bulk Commodities section as Radiant Barrier and Radiant Energy Shield commodities. See Table 2.4.4-1, Bulk Commodities - Component Types Subject to Aging Management Review.

References

UFSAR Sections: 1.1 / 1.2.1.1.2 / 1.2.2.4.9.1 / 1.2.2.4.9.3 / 1.2.2.7.2 / 2.4.13.5.1 / 3.1.2.2.7 / 3.5.1.2.1 / 3.5.1.2.2 / 3.6.2.4.2 / 3.8.1 / 3.8.1.1 / 3.8.1.8.1 / 3.8.2.1.1 / 3.8.2.1.2 / 3.8.2.1.3 / 3.8.2.1.6.a / 3.8.2.6.1 / 3.8.3.1.1 / 3.8.3.1.2 / 3.8.3.1.3 / 3.8.4.1.1 / 3.8.5 / 3.8.5.3.4 / 6.2.3.1 / 6.2.4.1 / 6.2.7.3.3 / 9.1.2 / 9.1.2.3.3 / 9.1.4.2.2.1 / 9.1.4.2.7 / 9.1.4.2.7.1 / 9.1.4.2.7.2

UFSAR Figures: 3.8-1 / 3.8.6 / 3.8-24 / 3.8-26 / 3.8-31 / 3.8-82

UFSAR Tables: 2.5-72 / 3.2-1 / 3.5-3 / 3.8-9 / 6.2-40

License Renewal Drawing:

Perry LR Site Map

2.4.2 TURBINE BUILDINGS AND ASSOCIATED STRUCTURES, PROCESS FACILITIES, YARD STRUCTURES AND UNIT 2 STRUCTURES

The following structures are included in this review:

Turbine Building, Unit 1 (2.4.2.1)

Turbine Power Complex (Condensate Demineralizer Building), Unit 1 (2.4.2.2)

Steam Tunnel, Unit 1 (2.4.2.3)

Auxiliary Boiler Building (2.4.2.4)

Heater Bay, Unit 1 (2.4.2.5)

Auxiliary Building, Unit 1 (2.4.2.6)

Control Complex (2.4.2.7)

Diesel Generator Building (2.4.2.8)

Intermediate Building (2.4.2.9)

Fuel Handling Building (2.4.2.10)

Offgas Building, Unit 1 (2.4.2.11)

Radioactive Waste Building (2.4.2.12)

Service Building (2.4.2.13)

Reactor Building, Unit 2 (2.4.2.14)

Auxiliary Building, Unit 2 (2.4.2.15)

Turbine Building, Unit 2 (2.4.2.16)

Turbine Power Complex (Condensate Demineralizer Building), Unit 2 (2.4.2.17)

Heater Bay, Unit 2 (2.4.2.18)

Offgas Building, Unit 2 (2.4.2.19)

Steam Tunnel, Unit 2 (2.4.2.20)

Central Oil Unloading/Tank Fill Station (2.4.2.21)

Diesel Generator Fuel Oil Tank Maintenance Structures (2.4.2.22)

Circulating Water Pumphouse (2.4.2.23)

Condensate Storage Tank Dike and Instrument Missile Shield (2.4.2.24)

Foundations (Tanks, Transformers, Transmission Towers, etc.) (2.4.2.25)

Fuel Oil Storage Tank Dike (2.4.2.26)

Fuel Oil Pumphouse (2.4.2.27)

High Mast Light #7 (2.4.2.28)

Hydrant Houses (2.4.2.29)

Manholes and Duct Banks (2.4.2.30)

Primary Access Facility (2.4.2.31)

Railroad Bridge (2.4.2.32)

Service Water Valve Pit (2.4.2.33)

Spent Fuel Dry Storage (SFDS) Electrical Building (2.4.2.34)

Thrust Blocks (2.4.2.35)

Transformer Concrete Curbs and Fire Barriers (2.4.2.36)

Transmission Towers (2.4.2.37)

Valve Support Slabs (2.4.2.38)

Water Treatment Building (2.4.2.39)

Notes:

1. Structural bulk commodities located within all the in-scope structures are described in Section 2.4.4.
2. See Table 2.4.2-1 for a list of Component Types Subject to Aging Management Review and the respective component intended functions supporting the Structures intended functions.
3. License Renewal Drawing: Perry LR Site Map

2.4.2.1 Turbine Building, Unit 1

Description

The turbine building is a non-seismic Category I structure located north of the Unit 1 auxiliary building. The turbine building is a five-story structure, bounded by the water treatment building on the west, the offgas building, turbine power complex and steam tunnel along most of the south wall, and is partially bounded by the heater bay and auxiliary boiler building on the north. The remainder of the north, south and east walls are exposed. The turbine building has two overhead cranes (east and west) and both cranes are considered as structural bulk commodities for the purpose of aging management review.

The turbine building houses the turbine generator and related auxiliaries, condensing equipment, moisture separator-reheaters, the first two stages of feedwater heating, some of the piping/equipment for the offgas system, and part of the offgas building ventilation equipment.

The entire five story building is considered a single fire area. The turbine building supports and protects: the main condenser credited for limiting the radiological consequences of a control rod drop accident; feedwater piping credited to support feedwater leakage control post-LOCA; and main steam and extraction steam piping and valves credited to mitigate turbine trip events.

Walls separating the turbine building from other buildings are constructed of either reinforced concrete or drywall and are 3-hour fire resistance rated. Floors are of reinforced concrete with numerous penetrations and metal gratings where equipment extends through floors. The roof is of steel frame and metal deck construction with roofing that meets fire protection requirements. Doorways in boundary walls between the turbine building and other buildings are equipped with Class A fire doors. Other penetrations in these boundary walls are sealed to provide a 3-hour fire resistance rating.

Although there are safety-related instruments in the turbine building, failure of the building would not prevent accomplishment of their credited safety functions (reactor protection or leak detection). Power cables from the Unit 1 Startup Transformer are routed through the turbine building to the Turbine Power Complex, an offsite power source credited for recovery from station blackout.

In the event of a postulated circulating water line break in the turbine building, the resultant internal flooding would be limited by isolation of service water make-up to the circulating water system using safety-related valves activated by a signal from water level indicators in the turbine building. Several turbine building wall penetrations are designed to allow flooding of the adjacent heater bay and condensate demineralizer building to maximize the amount of internal flooding volume within the turbine building complex.

Total failure of the turbine building due to tornado loads is precluded by design. The design approach used is based on a building siding that blows off at a predictable wind load, considerably below maximum tornado wind pressure. Therefore, the critical load on the turbine building is the tornado wind pressures on the structural skeleton of the building. The structural components of the turbine building, including the foundation, are designed for these tornado wind pressures.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection and station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The turbine building Unit 1 has the following intended functions for 10 CFR 54.4 (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63). [10 CFR 54.4(a)(3)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (mitigation of control rod drop accident, turbine trip, internal flooding, and feedwater leakage post-LOCA). [10 CFR 54.4(a)(2)]

References

UFSAR: 1.2.2.8.13 / 2.4.5 / 2.4.1.1 / 2.4.2.2 / 2.4.10 / 2.4.13.5.2 / 3.3.2.3 / 10.4.5.3.1 / 7.2.1.2 / Appendix 9A.4.16 / 15.8.2 / Figure 1.2-2 / Table 3.2-1

2.4.2.2 Turbine Power Complex (Condensate Demineralizer Bldg.), Unit 1

Description

The turbine power complex is a four-story structure. The Unit 1 turbine power complex is bounded by the turbine building on the north, the steam tunnel on the east and the offgas building on the west; the south wall is partially bounded by the auxiliary building with the remainder of the wall exposed.

This building contains equipment for the condensate demineralizer system, condensate filtration system, motor control centers, dc distribution equipment, and metal clad switchgear. The entire turbine power complex is considered a single fire area.

The turbine power complex exterior walls are constructed of metal siding. Walls adjacent to other buildings are of reinforced concrete or drywall construction. These walls have 3-hour fire resistance ratings and penetrations are provided with 3-hour fire rated seals. Doorways to adjacent structures are equipped with Class A fire doors. Floors are constructed of reinforced concrete. The roof is of metal deck construction with roofing that meets fire protection requirements.

The turbine power complex, Unit 1, has the condensate demineralizer building as its basement. The turbine power complex is a non-seismic Category I structure that is adjacent to the seismic Category I Unit 1 auxiliary building. The condensate demineralizer building volume is used to mitigate internal flooding from a circulating water line break, and its penetrations prevent flooding of the seismic Category I, Unit 1 auxiliary building below the 599 ft. elevation. The turbine power complex, Unit 1 provides support and shelter for electrical equipment that connects the Unit 1 startup transformer to the safety-related electrical power system.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection and station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The turbine power complex, Unit 1 has the following intended functions for 10 CFR 54 [10 CFR 54.4(a)(2)] and [10 CFR 54.4(a)(3)] [Reference 1.3-1]:

- Provide shelter, support and protection for nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]
- House equipment credited for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63). [Reference 1.3-7] [10 CFR 54.4(a)(3)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (internal flooding mitigation; Seismic II/I). [10 CFR 54.4(a)(2)]

References

UFSAR: 3.8.4 / Appendix 9A.4.11.1 / 10.4.5.3.1 / Figure 1.2-6

2.4.2.3 Steam Tunnel, Unit 1

Description

The Unit 1 steam tunnel is a structure with floor elevations at 614'-6" and 620'-6" that houses main steam, feedwater and other major pipes extending from the reactor building. The tunnel extends in the north-south direction from the reactor building through the auxiliary building at elevation 620'-6", connects to the east end of the turbine power complex and continues to the turbine building. The portion of this structure from the reactor building to the end of the auxiliary building is safety-related, seismic Category I. The steam tunnel also serves to maintain radiological shielding around the main steam lines. The steam tunnel is considered one fire zone.

Walls, floor and ceiling are constructed of reinforced concrete. The east and west walls and the south reactor building walls are 3-hour rated and penetrations are provided with 3-hour rated fire seals. There is no wall adjacent to the turbine building. The floor is 3-hour rated and penetrations are provided with 3-hour fire rated seals. Access to the steam tunnel is through roof hatches at elevation 652'-0" from the auxiliary building, or from doorways/openings in the turbine building.

Beyond the auxiliary building, the steam tunnel, Unit 1, is a non-seismic Category I structure that is adjacent to the seismic Category I auxiliary building. Although there are safety-related instruments in this part of the steam tunnel, failure of the building would not prevent accomplishment of the credited safety function (leak detection). The steam tunnel is integral to the auxiliary building steam tunnel fire area.

The steam tunnel serves as a conduit for essentially all high energy piping between the reactor building and the turbine building. The steam tunnel is designed to contain the environmental effects (pressure and temperature) resulting from a full circumferential pipe break (double ended rupture) of either a main steam or feedwater pipe. Following such a postulated event, the steam tunnel vents the blowdown from the break to the turbine building. Rapid closing isolation valves close to limit the release of mass and energy from the break. Feedwater piping in the Unit 1 steam tunnel maintains its integrity post-LOCA to support feedwater leakage control.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, and it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The steam tunnel, Unit 1 has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2)]

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (internal flooding mitigation; Seismic II/I). [10 CFR 54.4(a)(2)]
- Houses equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7] [10 CFR 54.4(a)(3)]

References

UFSAR: 3.8.4.1.2 / 7.3.1.1.2 / Appendix 9A.4.8.1 / Figure 1.2-6 / Table 3.2-1

2.4.2.4 Auxiliary Boiler Building

Description

The auxiliary boiler building is a one-story structure. The building is located at the northeast corner of the plant. It is bounded on the south by the turbine building and on the west by the heater bay; the north and east walls are exposed. The auxiliary boiler building houses the auxiliary boiler, piping and other equipment associated with the auxiliary boiler system. The entire building is considered a single fire area.

The south and west walls separate the auxiliary boiler building from adjacent buildings and are constructed of reinforced concrete. The north and east walls are exposed to the outside and are constructed of metal siding. Walls to adjacent buildings have 3-hour fire resistance ratings with penetrations provided with 3- hour fire rated seals. Doorways to adjacent buildings are equipped with Class A fire doors. The floor is constructed of reinforced concrete and the roof is of steel frame and metal deck construction with roofing that meets FM Class I requirements.

The auxiliary boiler building is a non-seismic Category I structure that is not near any seismic Category I structures. There is in-scope fire protection water piping inside the auxiliary boiler building. There are no safe shutdown components in the auxiliary boiler building.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection.

The auxiliary boiler building has the following intended functions for 10 CFR 54.4 (a)(3) [Reference 1.3-1]:

- House equipment credited for fire protection (10 CFR 50.48) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: 3.6.2.3.5.8 / Appendix 9A.4.17.1 / Figure 1.2-2

2.4.2.5 Heater Bay, Unit 1

Description

The heater bay is a four-story structure. The heater bay is bounded by the turbine building on the south, with the north and west walls exposed; most of the east wall is bounded by the auxiliary boiler building with the remainder of the wall exposed.

This building contains heaters associated with the condensate, feedwater and building heating systems, and pumps for feedwater and building heating. The entire heater bay is considered a single fire area. Walls are constructed of reinforced concrete, except for metal siding on the north wall. Doorways to adjacent buildings are equipped with Class A fire doors. Walls to adjacent buildings have 3-hour fire resistance ratings with all penetrations having 3-hour fire rated seals. Floors are constructed of reinforced concrete. Feedwater piping in the heater bay maintains its integrity post-LOCA to support feedwater leakage control. There is no safe shutdown equipment located in the heater bay.

The heater bay, Unit 1, is a non-Seismic Category I structure that is not near any Seismic Category I structures. There is in-scope fire protection water piping inside heater bay, Unit 1. The heater bay is credited with mitigation of internal flooding from the circulating water line break.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The heater bay, Unit 1 has the following intended functions for 10 CFR 54.4 (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (external and internal flooding mitigation). [10 CFR 54.4(a)(2)]
- House equipment credited for fire protection (10 CFR 50.48) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: 3.6.2.3.5.8 / 3.8.4 / Appendix 9A.4.12 / 10.4.5.3.1 / Figure 1.2-2

2.4.2.6 Auxiliary Building, Unit 1

Description

The auxiliary building, Unit 1, is a three-story seismic Category I structure that is adjacent to the seismic Category I reactor building, radioactive waste and intermediate buildings. It is also adjacent to the non-seismic Category I Unit 1 turbine power complex and steam tunnel. The auxiliary building, Unit 1 is a concrete structure approximately 97 feet high by 102 feet wide by 192 feet long with the top of mat at elevation 568 feet 4 inches. The concrete floors are supported by interior columns, interior walls and by exterior walls. Exterior walls and the roof are a minimum of two feet thick for protection of safety-related equipment from exterior missiles, tornado wind pressure, and tornado depressurization. This building houses safety class systems and components for plant operation such as the residual heat removal (RHR) system, reactor core isolation cooling (RCIC) system, high and low pressure core spray (HPCS, and LPCS, respectively), reactor water cleanup (RWCU) system, and ventilation systems.

The auxiliary building has a tunnel to house the main steam and feedwater lines which run from the reactor building complex to the turbine building steam tunnel. The auxiliary building tunnel is approximately 36 feet wide and 28 feet high. The function of this tunnel is to withstand the pressures and temperatures that could be produced by a postulated break in a feedwater or main steam line. Seals are provided around the tunnel at its junction with the steam tunnel on one end and a similar tunnel coming from the shield building on the other end. The seals do not form a structural connection to these other tunnels and, therefore, the auxiliary building remains structurally separate from other buildings above the foundation.

The auxiliary building, Unit 1, is a three-story building. Doorways are equipped with fire doors. Walls and ceilings have 3-hour fire resistance ratings. Wall and ceiling penetrations have 3-hour fire rated seals.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection, equipment qualification, anticipated transients without scram, and for station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The auxiliary building, Unit 1 has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1); 10 CFR 54.4(a)(2)]

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48), for equipment qualification (10 CFR 50.49), for anticipated transients without scram (10 CFR 50.62), and for station blackout (10 CFR 50.63) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: 3.3.2.2 / 3.8.4.1.2 / Appendix 9A.4.2 / Appendix 15C / Appendix 15.H / Figure 1.2-2 / Table 3.2-1

2.4.2.7 Control Complex

Description

The control complex is a seismic Category I structure that is located between the seismic Category I diesel generator building and intermediate building. It is also adjacent to the seismic Category I radwaste building on the north and the non-seismic Category I service building on the south. This building is a steel framed structure with exterior concrete walls of approximate dimensions 132-feet high, 141-feet wide and 142-feet long, with the top of the foundation mat at elevation 574 feet 10 inches.

The outside walls and roof of the control complex are 2-feet thick concrete for shielding and protection from exterior missiles and tornado wind pressure. The interior structure consists of steel columns, girders and beams with the floor decks of concrete. The building has no structural connection with other structures. The control complex is designed to limit depressurization caused by a design basis tornado.

The control complex is a six-story structure. Floors one and two are below grade and house heating, ventilation, and air conditioning equipment, mechanical equipment, offices and meeting rooms. Both floors house safe shutdown equipment. The third floor houses the 4.16 kV and 480 volt switchgear, remote shutdown panels, and 480-volt motor control centers for safety-related equipment. The fourth floor houses 125-volt dc distribution equipment and batteries. Cable spreading areas are also located on the fourth floor.

The control room is located on the fifth floor. The sixth floor houses heating, ventilation and air conditioning equipment.

Fire service piping located in the control complex is seismically supported in cases where analysis showed that rupture could cause failure of safety-related equipment by flooding. A flood barrier at door IB-103 (an 18" tall steel curb) has been installed to prevent water from a service water leakage crack in the control complex from entering the intermediate building.

The control room envelope comprises those areas to which the control room operator could require access during an emergency. The envelope includes those components that provide a boundary between the environment inside the control room and surrounding atmosphere. The components include the control room ventilation system, structural penetrations (electrical and mechanical), access doors (plenum, duct, personnel), door seals, as well as the walls, ceiling, and floor of the 654' elevation of the control complex and duct chase.

Housed within this control room envelope are the monitoring equipment, instrumentation and control panels required for safe operation and shutdown of the plant. The control room envelope is provided with fire protection equipment, adequate lighting, communications equipment, kitchen, sanitary, administrative and storage facilities, and spaces necessary to perform the normal plant operations required to maintain the plant in a safe condition following an accident.

Radiation protection, as required by 10 CFR 50.67 [Reference 1.3-7], is provided by shield walls on the four exposures, shield slabs at floor and ceiling, radiation monitoring equipment, and emergency filtering systems.

Sanitary fixtures inside the control room provide loop seals for maintaining the integrity of the control room envelope to protect personnel. Sanitary fixtures are considered as bulk commodities.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection, anticipated transients without scram, and for station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The control complex has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (internal flooding mitigation). [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48), for anticipated transients without scram (10 CFR 50.62) and for station blackout (10 CFR 50.63). [10 CFR 54.4(a)(3)]

References

UFSAR: 3.8.4.1.5 / 6.4 / 9.5.1.1.5 / and Appendix 9A.4.4 / Figure 1.2-2; / Table 3.2-1

2.4.2.8 Diesel Generator Building

Description

The diesel generator building is a seismic Category I structure that is located adjacent to the seismic Category I radioactive waste building and control complex, and to the non-seismic Category I service building. This structure is a reinforced concrete building approximately 165-feet long, 78-feet wide and 26-feet high, with the top of the foundation mat at elevation 620 feet 6 inches. The structural system consists of walls and a roof sized for protection against internal and external missiles. The exposed reinforced concrete walls and roofs of Seismic Category I structures have a minimum concrete thickness of 24 inches.

A reinforced concrete air intake and exhaust structure, 165-feet long, 32-feet wide and 20-feet high, is mounted to the roof of the building. The walls and top of this housing are also designed for missile protection, tornado wind pressure and tornado depressurization. In addition, concrete barriers are provided at the ventilation exhaust louvers to prevent external missiles from entering the diesel generator building.

The diesel generator building houses emergency generators, day tanks and other equipment necessary to supply standby electric power to operate safety systems in the event of a power failure of the plant generating equipment and offsite power.

Insulation has been installed within the emergency diesel generator exhaust missile barrier to protect the concrete from the combustion exhaust heat. During diesel generator operation, the temperature of the concrete surface is within the ACI 349 guidelines for short term operation.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection and station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The diesel generator building has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2)]

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis, for fire protection (10 CFR 50.48 [Reference 1.3-7]) and for station blackout (10 CFR 50.63 [Reference 1.3-7]) [10 CFR 54.4(a)(3)]

References

UFSAR: 3.8.4.1.7 / Appendix 9A.4.5.1 / Figure 1.2-2 / Table 3.2-1

2.4.2.9 Intermediate Building

Description

The intermediate building and fuel handling building share a common integral structure but are evaluated separately based on their unique functions. The intermediate building is a five-story reinforced concrete seismic Category I structure located between the fuel handling building and the control complex in the east-west direction and the two reactor buildings in the north-south direction. A 3-inch rattle space isolates the intermediate and fuel handling buildings from all other structures. The exterior walls are sized to insure protection from exterior missiles. The top of the foundation mat is at elevation 574'-10". The exposed walls and roofs of seismic Category I structures have a minimum concrete thickness of 24-inches and are reinforced each way on each face.

The function of the intermediate building is to house safety-related systems and equipment. Some of the systems in the intermediate building include the fuel pool cooling and cleanup system, reactor building chilled water systems, the annulus exhaust gas treatment system, reactor building and drywell purge system, and ventilation system equipment for the intermediate building and the fuel handling building.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection and anticipated transients without scram. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The intermediate building has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1); 10 CFR 54.4(a)(2)]

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7] and for anticipated transients without scram (ATWS) (10 CFR 50.62) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: 3.8.4.1.4 / Appendix 9A.4.3 / Appendix 15C.5 / Figure 1.2-2 / Table 3.2-1

2.4.2.10 Fuel Handling Building

Description

The fuel handling building is a three-story building. The approximate plan dimensions are 144 feet by 108 feet with the top of the foundation mat at elevation 574 feet, 10 inches. The entire exterior of the building is reinforced concrete including the foundation, the walls and the roof slab. The seismic Category I building is designed to withstand tornado missiles, tornado wind pressure and tornado depressurization. The roof slab is supported by structural steel framing. Reinforced concrete is also used for the interior walls and slabs. The exposed walls and roofs of seismic Category I structures have a minimum concrete thickness of 24-inches and are reinforced each way on each face.

The functions of the fuel handling building are:

- Store new and spent fuel assemblies;
- House safety class equipment required to maintain the fuel assemblies;
- Protect the fuel assemblies and safety class equipment from the effects of the environment;
- Provide access to containment through the equipment access hatch;
- House additional safety-related equipment required to secure systems in the containment structure.

The fuel handling building is provided with four pools for fuel handling and storage. The pools are interconnected by means of gates, to allow the underwater passage of fuel assemblies from one pool to another. Each pool is a stainless steel lined concrete structure. The pool concrete structure with the liner is designed to seismic Category I requirements to prevent damage to the stored fuel. Spent fuel in the fuel handling building pools is stored in densified racks.

An overhead gantry crane is provided to handle and maneuver fuel assemblies between pools. A bridge crane traveling at right angles to the gantry crane handles fuel casks.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The fuel handling building has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal [10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2)].
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected [10 CFR 54.4(a)(2)].
- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7] [10 CFR 54.4(a)(3)].

References

UFSAR: 3.8.4.1.3 / Appendix 9A.4.7 / Appendix 15C.5 / Figure 1.2-2 / Table 3.2-1

2.4.2.11 Offgas Building, Unit 1

Description

The offgas building, Unit 1 is a seismic Category I structure that is located adjacent to the non-seismic Category I Unit 1 turbine power complex and turbine building. This building is a reinforced concrete structure that houses equipment used in the filtering and absorption of radioactive non-condensable gases from the main and auxiliary condensers. The building is a four-story structural system that is completely enclosed by a 2-foot thick roof slab and exterior walls of 2-foot minimum thickness, which are designed to resist the postulated exterior missiles, tornado wind pressure and tornado depressurization. The top of the concrete mat foundation is at elevation 584 feet.

Functions (and scoping criteria, if intended function)

The offgas building is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, and it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The offgas building, Unit 1 has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1)]; [10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (Seismic II/I). [10 CFR 54.4(a)(2)]
- Houses equipment credited for fire protection (10 CFR 50.48) [Reference 1.3-7], [10 CFR 54.4(a)(3)]

References

UFSAR: 3.8.4.1.8 / Appendix 9A.4.13.1 / Figure 1.2-2 / Table 3.2-1

2.4.2.12 Radioactive Waste Building

Description

The radioactive waste (radwaste) building is a seismic Category I structure that is located adjacent to the seismic Category I diesel generator building, control complex, intermediate building and auxiliary building, Unit 1. The safety-related portion of this building is a reinforced concrete structure of approximate dimensions 70 feet high, 101 feet wide and 217 feet long, with the top of the foundation mat at elevation 574 feet 10 inches. The radwaste building houses equipment used in the storage and processing of liquid and solid radioactive wastes. The exterior walls and roof of the safety class portion of the structure consists of 2 and 3 foot thick reinforced concrete to provide radiation shielding from the radioactive wastes.

Although the radwaste building contains no safety-related mechanical components, there are three safety-related conduits at Elevation 621 feet (approximately). The conduits support and protect electrical cables between the Control Complex on the south and an underground duct bank at the north wall of the radwaste building. There is in-scope fire protection water piping inside the radwaste building.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and non-safety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The radioactive waste building has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1); 10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: 3.8.4.1.6 / Appendix 9A.4.14 / Figure 1.2-2 / Table 3.2-1

2.4.2.13 Service Building

Description

The service building is a three-story structure. It is bounded by the diesel generator building and control complex on the north, the intermediate building on the east, with the south and west walls exposed. The east wall is exposed above the roof of the hot shop addition. The service building contains offices, administrative facilities and shops for the plant, the security office, and the technical support center (TSC). The TSC is located in the basement. This entire three-story building, together with the basement, is considered a single fire area.

The service building north wall of the basement is constructed of reinforced concrete and constitutes a 3-hour rated fire barrier. Above elevation 620'-6" the north wall is constructed of drywall. Above the service building hot shop roof the east wall is an exterior wall constructed of metal siding. The south and west walls are exterior walls constructed of metal siding. The east side of the hot shop abuts the west wall of the Intermediate Building, which has a three-hour fire rating. The roof is of steel frame and metal deck construction with roofing that meets fire protection requirements. Doorways in the north wall are equipped with class A fire doors. A class A roll-up door is provided in the east side of the hot shop (el. 620'-0") in the intermediate building wall. Penetrations in the north wall are sealed to provide a 3-hour fire resistance rating.

No safe shutdown equipment is located in the service building.

Total failure of the service building due to tornado loads is precluded by design. The design approach used is based on building siding that blows off at a predictable wind load, considerably below maximum tornado wind pressure. Therefore, the critical load on the service building is the tornado wind pressures on the structural skeleton of the building. The structural components of the service building, including the foundation, are designed for these tornado wind pressures.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The service building has the following intended functions for 10 CFR 54.4 (a)(2) and (a)(3) [Reference 1.3-1]:

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: 3.3.2.3 / Appendix 9A.4.18 / Figure 1.2-5 / Figure 1.2-6 / Figure 8.2.3 / Figure 9A-11 / Figure 9A-12

Unit 2 Structures

On November 1, 2001, the NRC issued a letter to First Energy Nuclear Operating Company (FENOC) concluding that the Unit 2 Construction Permit (CP) CPPR-149 had been terminated (TAC NO. MA2219). This letter also referred to a PNPP letter to the NRC dated December 29, 1994 (PY-CEI/NRR-1899L), which included a Site Stabilization Plan. The Site Stabilization Plan stated the following:

> *"The Site Stabilization Plan concludes that termination of the PNPP, Unit 2, CP will not adversely impact the safe operation of PNPP, Unit 1. The licensee asserted that final reclamation and restoration of the PNPP site will be addressed upon decommissioning of PNPP, Unit 1. Systems and equipment that were originally to be shared by both units or intended for Unit 2, but are now used to support Unit 1 operations, will continue under full control of PNPP, Unit 1 programs. In addition, activities at the PNPP site which would have been conducted under the authority of the Unit 2 CP will be addressed, as appropriate, in PNPP, Unit 1, programs. Examples of such activities include the Physical Security Plan, the Quality Assurance Program, and the Fire Protection Program."*

The above statement is considered a commitment as issued in the Safety Evaluation Report (SER).

2.4.2.14 Reactor Building, Unit 2

Description

The reactor building Unit 2 is a safety-related, seismic Category I structure that is located adjacent to the seismic Category I intermediate, fuel handling, and Unit 2 auxiliary buildings. Although the reactor building Unit 2 was constructed similar to the Unit 1 reactor building, it contains no operating systems/equipment, it is not subject to any hydrodynamic loads, and its functions are limited to support and protection of interfacing systems/structures. A shield building forms a housing for the steel containment. The Unit 2 shield building is required to fulfill the structural integrity and shelter/protect license renewal functions.

The Unit 2 reactor building is a self-enclosed, domed structure that is seismically separated from adjacent structures by a 3-inch rattle space; however, the nuclear safety-related intermediate building and fuel handling building share part of the Unit 2 reactor building wall.

All piping and components going through penetrations to Unit 1 structures, regardless if active or retired-in-place, serve a license renewal function and act as a barrier to protect the spread of fire and flooding. The Unit 2 reactor building continues to remain as a seismic Category I structure.. The Unit 2 containment vessel acts as the anchor for structural integrity of some piping and components. The Unit 2 containment vessel functions are limited to structural support and as a rated fire barrier.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it provides shelter, support and protection for safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, and it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The Unit 2 reactor building has the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1)]; [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: 3.8.1.1 / 3.8.4.1.3.1 / 3.8.4.1.4 / Appendix 9A.4.23.1 / Appendix 9A.4.1 / Figure 1.2-2 / Figure 1.2-5 / Figure 1.2-6 /Figure 9A-3

2.4.2.15 Auxiliary Building, Unit 2

Description

The auxiliary building, Unit 2 is a seismic Category I structure that is adjacent to the Unit 2 reactor building and the intermediate building. It is also adjacent to the non-seismic Category I Unit 2 turbine power complex and steam tunnel. The Unit 2 auxiliary building is a concrete structure with the top of mat at elevation 568 feet, 4 inches. The concrete floors are supported by interior columns, interior walls and by exterior walls. Exterior walls and the roof are a minimum of two feet thick for protection of equipment from exterior missiles, tornado wind pressure, and tornado depressurization.

The Unit 2 auxiliary building combustible loading is very low. Due to the presence of combustibles, the Unit 2 auxiliary building has 3-hour rated fire separation from the intermediate building, which contains equipment required for Unit 1 operation. This separation is provided by the reinforced concrete intermediate building south wall, fire doors, and penetration seals. Penetrations, doors, and ducts are adequately sealed to prevent fire spread. The Unit 2 auxiliary building houses M38 system ducting and louvers that connect to the plant vent that serves to connect service building hot shop ventilation to the plant vent.

All piping and components going through penetrations from the Unit 2 auxiliary building to Unit 1 structures, regardless if active or retired-in-place, serve license renewal function and act as a barrier to protect the spread of fire and flooding.

The Unit 2 auxiliary building has no safety-related nor safe shutdown equipment. The building provides seismic support for nonsafety-related service water piping to meet break exclusion criteria.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it provides shelter, support and protection for nonsafety-related components that are relied upon to remain functional during or following a design basis event, and because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The Unit 2 auxiliary building, has the following intended functions for 10 CFR 54.4 (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: 3.6.2.3.5.2 / Appendix 9A.4.23.2 / Figure 1.2-2

2.4.2.16 Turbine Building, Unit 2

Description

The Unit 2 turbine building is a five-story structure bounded by the Unit 2 offgas building, Unit 2 turbine power complex and Unit 2 steam tunnel along the majority of the north wall, and is partially bounded by the Unit 2 heater bay on the south. The remainder of the north and south walls, and the east and west walls, are exposed. This building does not contain components required for safe shutdown of Unit 1 and is not designated as a fire area. Also, the Perry Appendix R Evaluation, Safe Shutdown Capabilities Report, does not credit turbine building Unit 2 for fire protection. However, it does contain equipment that supports Unit 1 operation. Walls separating the turbine building from other buildings are constructed of either reinforced concrete or drywall. Floors are of reinforced concrete with numerous penetrations and metal gratings where equipment extends through floors. The roof is of steel frame and metal deck construction.

Fire propagation from the Unit 2 turbine building to the Unit 1 buildings is prevented by spatial separation of the buildings and the 3-hour rated barriers between the Unit 2 reactor building, Unit 2 auxiliary building and the intermediate building.

The Unit 2 turbine building is a non-seismic Category I structure that is not near any seismic Category I structures. A number of the turbine building penetrations are designed to control flooding by allowing service water to flow into the adjacent heater bay and condensate demineralizer buildings. The source of service water is postulated to be from a service water piping crack or break in the Unit 2 turbine power complex.

Power cables from the Unit 2 startup transformer are routed through the Unit 2 turbine building to the Unit 2 turbine power complex.

P54 fire water piping to Unit 2 startup transformer is routed through the Unit 2 auxiliary building, turbine power complex (and condensate demineralizer building), and Unit 2 turbine building.

Total failure of the turbine building due to tornado loads is precluded by design. The design approach used is based on building siding that blows off at a predictable wind load, considerably below maximum tornado wind pressure. Therefore, the critical load on the turbine building is the tornado wind pressures on the structural skeleton of the building. The structural components of the turbine building, including the foundation, are designed for these tornado wind pressures.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it provides shelter, support and protection for nonsafety-related components that are relied upon to remain functional during or following a design basis event, and because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions. The structure is also relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection.

The Unit 2 turbine building, has the following intended functions for 10 CFR 54.4 (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- House equipment credited for station blackout (10 CFR 50.63) [10 CFR 54.4(a)(3)].
- Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). [10 CFR 54.4(a)(3)]

References

UFSAR: 3.3.2.3 /3.6.2.3.5.9.2 / Appendix 9A.4.23 / Appendix 9A.4.23.5 / Figure 1.2-2 / Table 3.2-1

2.4.2.17 Turbine Power Complex (Condensate Demineralizer Bldg.), Unit 2

Description

The Unit 2 turbine power complex is a four story structure bounded by the Unit 2 turbine building on the south, the Unit 2 steam tunnel on the east and the Unit 2 offgas building on the west; the north wall is partially bounded by the Unit 2 auxiliary building with the remainder of the wall exposed. This building does not contain components required for safe shutdown of Unit 1 and is not designated as a fire area. Also, the Perry Appendix R Evaluation, Safe Shutdown Capabilities Report does not credit the Unit 2 turbine power complex for fire protection. However, it does contain equipment that supports Unit 1 operation.

Exterior walls are constructed of metal siding. Walls adjacent to other buildings are of reinforced concrete or drywall construction. These walls are built to 3-hour rated construction specifications; however, all penetrations are not sealed. Doorways to the adjacent Unit 2 auxiliary building are equipped with fire doors. Floors are constructed of reinforced concrete. The roof is of metal deck.

With the presence of smoke detection in Unit 2 turbine power complex, the low combustible loading in the adjacent Unit 2 auxiliary building, and the 3-hour fire barrier separating Unit 2 reactor building, the Unit 2 auxiliary building, and the intermediate building, adequate protection is provided to prevent fire propagation from the Unit 2 turbine power complex to Unit 1 fire areas.

The Unit 2 turbine power complex has the condensate demineralizer building as its basement. The Unit 2 turbine power complex is a non-seismic Category I structure located adjacent to the seismic Category I Unit 2 auxiliary building. Parts of the structure are retired in place. The condensate demineralizer building volume is used to mitigate internal flooding from a service water line break, and its penetrations prevent flooding of the Unit 2 auxiliary building below the 599 ft. elevation. The Unit 2 turbine power complex provides support and shelter for electrical equipment that connects the Unit 2 startup transformer to the safety-related electrical power system.

P54 fire water piping to the Unit 2 startup transformer is routed through Unit 2 auxiliary building, Unit 2 turbine power complex (and condensate demineralizer building), and Unit 2 turbine buildings.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it provides shelter, support and protection for nonsafety-related components that are relied upon to remain functional during or following a design basis event, and because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions. The structure is also relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection.

The Unit 2 turbine power complex has the following intended functions for 10 CFR 54.4 (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for nonsafety-related equipment within the scope of license renewal [10 CFR 54.4(a)(2)].
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected [10 CFR 54.4(a)(2)].
- House equipment credited for station blackout (10 CFR 50.63 [Reference 1.3-7]) [10 CFR 54.4(a)(3)].

- Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) [Reference 1.3-7] [10 CFR 54.4(a)(3].

References

UFSAR: 3.6.2.3.5.9.2 / 3.8.4 / Appendix 9A.4.23.3 / Figure 1.2-6

2.4.2.18 Heater Bay, Unit 2

Description

The Unit 2 heater bay is a four-story structure bounded by the Unit 2 turbine building on the north, with the east, south and west walls exposed. This building does not contain components required for safe shutdown of Unit 1 and is not designated as a fire area. Walls are constructed of reinforced concrete, except for metal siding on the south wall. Walls to adjacent buildings have 3-hour rated construction. Floors are constructed of reinforced concrete. Fire propagation from the Unit 2 heater bay to Unit 1 buildings is prevented by spatial separation of the buildings and the 3-hour rated barriers between the Unit 2 auxiliary building and the intermediate building.

The Unit 2 heater bay is a non-seismic Category I structure that is not near any seismic Category I structures. There is a section of in-scope fire protection water piping inside the Unit 2 heater bay. The heater bay is credited with mitigation of internal flooding from a service water line break. Penetrations between the Unit 2 heater bay and the Unit 2 turbine building have been credited for internal flood protection.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions. The Unit 2 heater bay has the following intended functions for 10 CFR 54.4 (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (external and internal flooding mitigation). [10 CFR 54.4(a)(2)]
- House equipment credited for fire protection (10 CFR 50.48 [Reference 1.3-7]). [10 CFR 54.4(a)(3)]

References

UFSAR: 3.6.2.3.5.9.2 / 3.8.4 / Appendix 9A.4.23.4 / Figure 1.2-2

2.4.2.19 Offgas Building, Unit 2

Description

The Unit 2 offgas building is located adjacent to the Unit 2 turbine power complex and Unit 2 turbine building. The building is a four-story structure that is completely enclosed by 2-foot thick reinforced concrete roof slab and exterior walls, which are designed to resist the postulated exterior missiles, tornado wind pressure and tornado depressurization. This building does not contain components required for safe shutdown of Unit 1 and is not designated as a fire area. Fire propagation from the Unit 2 offgas building to the Unit 1 buildings is prevented by spatial separation of the buildings and the 3-hour rated barriers between the Unit 2 auxiliary building and the intermediate building.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The Unit 2 offgas building has the following intended function for 10 CFR 54.4 (a)(2) [Reference 1.3-1]:

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]

References:

UFSAR: 3.8.4.1.8 / Appendix 9A.4.23.6 / Figure 1.2-2

2.4.2.20 Steam Tunnel, Unit 2

Description

The Unit 2 steam tunnel is a structure located between Elevations 614”-6” and 620’-6” that was designed to house main steam, feedwater and other major pipes extending from the Unit 2 reactor building. The tunnel extends in the north-south direction from the Unit 2 reactor building, through the Unit 2 auxiliary building at Elevation 620’-0”, connects to the east end of the Unit 2 turbine power complex, and continues to the Unit 2 turbine building. It is constructed of reinforced concrete. This structure does not contain components required for safe shutdown of Unit 1 and is not designated as a fire area. Fire propagation from the Unit 2 Steam Tunnel to the Unit 1 buildings is prevented by the 3-hour rated barriers between the Unit 2 reactor building and the intermediate building, and the Unit 2 auxiliary building and the intermediate building.

The steam tunnel, Unit 2 structure is credited for flood mitigation purposes.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The Unit 2 steam tunnel has the following intended function for 10 CFR 54.4 (a)(2) [Reference 1.3-1]:

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (external flooding mitigation). [10 CFR 54.4(a)(2)]

References:

UFSAR: Appendix 9A.4.23.7

Yard Structures

2.4.2.21 Central Oil Unloading/Tank Fill Station

Description

The central oil unloading/tank fill station is a Seismic Category I structure located west of the Seismic Category I diesel generator building. The structure provides a central location for unloading diesel fuel for the underground diesel generator fuel tanks. The above ground piping is protected by missile shields.

Flood barriers are used to ensure that the floodwater elevations for a local intense precipitation event do not exceed and enter the Unit 1 diesel generator flame arrestors.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event and includes nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The central oil unloading/tank fill station has the following intended functions for 10 CFR 54.4 (a)(1) and (a)(2) [Reference 1.3-7]:

- Provide shelter, support and protection for safety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]

References

UFSAR: 9.5.4 / Figure 1.2-2 / Table 1.8-1 / 3.5-5 / 3.5-6

2.4.2.22 Diesel Generator Fuel Oil Tank Maintenance Structures

Description

The diesel generator fuel oil tank maintenance structures are seismic Category I structures located near the seismic Category I diesel generator building. The maintenance structures are concrete structures that provide access to the underground diesel fuel oil storage tanks. The maintenance structures also provide tornado missile protection to the tanks and associated mechanical components.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event.

The diesel generator fuel oil tank maintenance structures have the following intended functions for 10 CFR 54.4 (a)(1) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1)]

References

UFSAR: 9.5.4.3 / Appendix 9A.4.6.2.1 / Figures 1.2-2 / 9.5-22 sheet 2 / Table 3.5-5

2.4.2.23 Circulating Water Pumphouse

Description

The circulating water pumphouse is a non-Seismic Category I steel-framed structure that is not near any Seismic Category I structures. There is in-scope fire protection water piping inside the pumphouse.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection. The circulating water pumphouse has the following intended functions for 10 CFR 54.4 (a)(3) [Reference 1.3-1]:

- House equipment credited for fire protection (10 CFR 50.48) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: Figure 1.2-2 / Table 3.2-1

2.4.2.24 Condensate Storage Tank Dike and Instrument Missile Shield

Description

The condensate storage tank (CST) dike and instrument missile shield is a seismic Category I structure that is not near any seismic Category I structures. The structures protect the CST and associated instrumentation. The CST is supported by a ring girder which in turn rests on a 3 feet-6 inch common foundation mat with the dike. To preclude an uncontrolled release of the content of the CST, the tank is located within a concrete retaining structure (dike) designed to seismic 1 requirements. The dike is designed to accommodate the total liquid capacity (i.e., 500,000 gallons) of the CST with at least one-foot freeboard.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event. The condensate storage tank dike and instrument missile shield have the following intended functions for 10 CFR 54.4 (a)(1) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1)]

References

UFSAR: 2.5.4.11.2 / 3.5.1.4.2 / 3.8.4.1.14 / 9.2.6.3

2.4.2.25 Foundations (Tanks, Transformers, Transmission Towers, etc.)

Description

The foundations (tanks, transformers, transmission towers, etc.) are foundations for yard structures that are of similar construction. Foundations that are associated with concrete yard structures are evaluated as part of those structures. The foundations for the following yard structures are evaluated in this general foundation category:

- carbon dioxide tank
- high mast light #7
- hydrant houses for fire hydrants
- interbus transformers
- start-up transformers
- transmission towers and other switchyard components

The carbon dioxide tank is north of the Seismic Category I fuel handling building and provides carbon dioxide for fire protection.

High mast light #7 is close enough to the safety-related intermediate building that it could strike the building if it were to fall.

Hydrant house foundations are in scope for each in-scope fire hydrant that is provided with a hydrant house.

Interbus and start-up transformers are available for SBO recovery.

Transmission towers and other switchyard components support the pathways available for SBO recovery. Transmission towers are located in the transmission switchyard and the Plant Yard.

Functions (and scoping criteria, if intended function)

The structures are within the scope of license renewal because they contain components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection and station blackout, and because they contain nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The foundations (tanks, transformers, transmission towers, etc.) have the following intended functions for 10 CFR 54 (a)(2) and (a)(3) [Reference 1.3-1]:

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- House or supports equipment credited in the Appendix R safe shutdown analysis for fire protection (10 CFR 50.48 [Reference 1.3-7]) and station blackout (10 CFR 50.63 [Reference 1.3-7]). [10 CFR 54.4(a)(3)]

References

UFSAR: Appendix 9A.4.9.2.1.1 / Appendix 9A.4.9.3.1 / Appendix 9A.4.9.4.1 / Appendix 9A.4.9.5 / Appendix 9A.5E.2 (g) / Figure 1.2-5 / Table 3.2-1

2.4.2.26 Fuel Oil Storage Tank Dike

Description

The reinforced concrete fuel oil storage tank dike surrounds the auxiliary boiler fuel oil storage tank that is located approximately 240 feet east of the Unit 1 auxiliary boiler and turbine buildings. The dike surrounds the tank to contain potential spillage which helps prevent a fire in this region of the yard area from spreading to buildings or locations containing safe shutdown equipment.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it is relied on to perform a function that demonstrates compliance with the regulations for fire protection.

The fuel oil storage tank dike has the following intended function for 10 CFR 54.4 (a)(3) [Reference 1.3-1]:

- Supports equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7], [10 CFR 54.4(a)(3)]

References

UFSAR: 2.2.3.1.3.1 / Appendix 9A.4.9.3

2.4.2.27 Fuel Oil Pumphouse

Description

The fuel oil pumphouse is a single-story structure located next to the auxiliary boiler fuel oil storage tank. The exterior walls are made of concrete blocks. The roof is made up of steel deck with foam insulation. This building houses fire protection piping, and suppression equipment associated with the auxiliary boiler fuel oil storage tank.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection.

The fuel oil pumphouse has the following intended function for 10 CFR 54.4 (a)(3) [Reference 1.3-1]:

- Supports equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7], [10 CFR 54.4(a)(3)].

References

UFSAR: 3.3.2.3 / 9.5.1.2.5.a

2.4.2.28 High Mast Light #7

Description

High mast light #7 is close enough to the safety-related fuel handling / intermediate building that it could strike the building if it were to fall.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it is a nonsafety-related component whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

High mast light #7 has the following intended function for 10 CFR 54.4 (a)(2) [Reference 1.3-1]:

- Maintain integrity of non-safety related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)].

References

None

2.4.2.29 Hydrant Houses

Description

Each in-scope fire hydrant is provided with a hydrant house containing 2-1/2 inch hose, combination fog nozzle and auxiliary equipment. Hydrant houses are prefabricated galvanized steel buildings.

Functions (and scoping criteria, if intended function)

The structures are within the scope of license renewal because they contain components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection.

- The hydrant houses have the following intended function for 10 CFR 54.4 (a)(3) [Reference 1.3-1]:
- Supports equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7], [10 CFR 54.4(a)(3)]

References

UFSAR: Appendix 9A.4.9.1.1/ Appendix 9A.4.9.2.1.1/ Appendix 9A.4.9.3.1/ Appendix 9A.4.9.4.1/ Appendix 9A.5E.2(g)

2.4.2.30 Manholes and Duct Banks

Description

Manholes

Manholes are reinforced concrete structures that are used in various systems. There are five safety-related in-scope electrical manholes, 13 underdrain manholes and 13 gravity discharge manholes that are in-scope. Manholes are seismic class 1 structures. The manhole roofs were designed to resist tornado missiles. In particular, the removable 30-inch deep beams were designed to resist a maximum equivalent static load determined from consideration of the impact of tornado missiles on the roof of the manholes.

Underdrain Manholes

The 13 underdrain manholes and the 13 gravity discharge manholes are all part of the pressure relief underdrain system. The in-scope manholes are seismic Category I structures. The underdrain manholes are reinforced concrete vertical shafts having rectangular cross sections with 18-inch thick walls. All 26 of the manholes are penetrated by the steel gravity drainpipe at approximate invert elevation 585’-0”. The underdrain manholes are also penetrated by a 12-inch diameter porous concrete pipe at elevation 568’-6” or lower. Manholes are concrete structures buried in structural backfill. All underdrain system manholes have gasketed, watertight covers installed at the surface.

Electrical Manholes

The electrical manholes are reinforced concrete boxes used as distribution points for cable routing. The manholes are all less than 18 feet deep, and approximately 15 feet by 15 feet in plan or smaller. The walls are 18 inches thick for four of the five safety class manholes and 12 inches thick for one relatively small manhole (7 feet by 7 feet in plan). All these manholes have 30-inch thick roofs for missile protection. Access to the manholes is provided through 30-inch deep removable concrete beams. Permanent steel curbing is installed around the hatches of four safety-related, electrical manholes to protect against flooding.

Note: There are four safety-related electrical manholes, however, the fifth manhole, even though constructed as safety-related and described in UFSAR, does not contain any SR cables. Therefore, for the purpose of aging management, the four safety-related electrical manholes are in scope. Electrical Manhole MH7, which is nonsafety-related, contains cables which perform a license renewal intended function and therefore is within the scope of license renewal.

Duct Banks

Duct banks are used at Perry to allow underground routing of cables and piping. Seismic Category I concrete underground duct banks support safety-related electrical cables. Other concrete underground duct banks support nonsafety-related cables for station blackout or fire protection. Duct banks are founded on compacted class A backfill or on controlled low strength material (CLSM). The concrete foundations for the duct banks have been designed using the code ACI-318-71 [Reference 1.3-18].

Functions (and scoping criteria, if intended function)

The manholes and duct banks are within the scope of license renewal because they provide shelter, support and protection for safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, and because they contain components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection and station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The manholes and duct banks have the following intended functions for 10 CFR 54.4 (a)(1), (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal [10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2)];
- Maintains integrity of nonsafety-related structural components such that safety functions are not affected (external flooding mitigation) [10 CFR 54.4(a)(2)]; and,
- House equipment credited in the Appendix R safe shutdown analysis for fire protection (10 CFR 50.48 [Reference 1.3-7]) and for station blackout (10 CFR 50.63 [Reference 1.3-7]) [10 CFR 54.4(a)(3)].

References

UFSAR: 2.4.13.5.1.d/3.8.4.o / 3.8.4.1.16 / Appendix 9A.4.9.2.2 / Figures 2.4-70; 2.4-71; 9A-1 and UFSAR Table 3.2-1

2.4.2.31 Primary Access Facility

Description

The primary access facility (PAF) is a non-seismic Category I steel framed structure that is not near any seismic Category I structures. The PAF is a two-story building located west of the service building. It is an isolated structure containing offices and personnel processing equipment. There is no safe shutdown equipment located in the PAF. There is a section of in-scope fire protection water piping inside the PAF.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection.

The primary access facility has the following intended functions for 10 CFR 54.4 (a)(3) [Reference 1.3-1]:

- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7], [10 CFR 54.4(a)(3)].

References

UFSAR: Appendix 9A.4.20/ Figure 1.2-2

2.4.2.32 Railroad Bridge

Description

The reconstituted major stream probable maximum flood (PMF) analysis introduces a new potential failure mechanism for the railroad bridge which could result in a downstream flow restriction should the bridge fail and inherently decreases the reliability of the bridge to perform as intended. This condition has been analyzed and based on the current configuration confirms that the bridge and supporting structure can withstand the resultant forces from the PMF including any debris that may be transported by the watercourse.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it is a nonsafety-related component whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The railroad bridge has the following intended function for 10 CFR 54.4 (a)(2) [Reference 1.3-1]:

- The railroad bridge is a nonsafety-related structure whose failure could prevent satisfactory accomplishment of any of the functions of safety-related systems (external flood mitigation), [10 CFR 54.4(a)(2)].

References

UFSAR: 2.4.3.5

2.4.2.33 Service Water Valve Pit

Description

The service water valve pit is a seismic Category I structure that is located east of the reactor building. The service water valve pit is an underground concrete structure approximately 18 feet high by 15 feet wide by 18 feet long, with the top of the mat at Elevation 602 feet. It houses safety class valves for the service water system. The concrete mat, walls and roof are two feet thick. The function of this structure is to protect the safety class service water valves from a seismic event and external missile hazards.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it provides shelter, support and protection for safety-related components that are relied upon to remain functional during or following a design basis event.

The service water valve pit has the following intended function for 10 CFR 54.4 (a)(1) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1)]

References

UFSAR: 3.8.4.n / 3.8.4.1.15 / 3.8.4.3.2.1.k / Figure 1.2-2 / Figure 3.8-75

2.4.2.34 Spent Fuel Dry Storage (SFDS) Electrical Building

Description

The spent fuel dry storage (SFDS) electrical building is a one story, non-seismic Category I concrete block structure with a steel roof that is not near any seismic Category I structures. There are flood barriers inside the SFDS electrical building.

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The SFDS electrical building has the following intended functions for 10 CFR 54.4 (a)(2) [Reference 1.3-1]:

- House nonsafety-related equipment that protects safety-related equipment from flooding. [10 CFR 54.4(a)(2)]

References

UFSAR: 9.1.4.2.10.14 / Appendix 9A.4.9.7 / Figure 1.2-2

2.4.2.35 Thrust Blocks

Description

Thrust blocks are underground concrete blocks that protect fire protection water piping from excessive movement.

Functions (and scoping criteria, if intended function)

The structures are within the scope of license renewal because they are relied on to perform a function that demonstrates compliance with the regulations of fire protection.

The Thrust Blocks have the following intended function for 10 CFR 54.4 (a)(3).

- Supports equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7] [10 CFR 54.4 (a)(3)].

References

None

2.4.2.36 Transformer Concrete Curbs and Fire Barriers (U1 Main, U1/2 Startup, U1/2 Interbus Transformers)

Description

The Unit 1 startup transformer, unit auxiliary transformer and main transformer (which consists of three single phase transformers) are located in the Unit 1 portion of the yard area just north of the turbine building and west of the heater bay and hydrogen storage tanks. Three Unit 1 interbus transformers are located along the outside of the south wall of the Unit 1 turbine power complex. The Unit 2 startup transformer is located just outside of the west wall of the Unit 2 turbine building. Three Unit 2 interbus transformers are located along the outside of the north wall of the Unit 2 turbine power complex.

Fire suppression for the Unit 1 main transformers, Unit 1 startup transformer and the Unit 2 startup transformer is provided by a water spray deluge system that is manually activated. Heat detectors located at each of these transformers provide annunciation signals to the Control Room that can be used to determine if initiation of the deluge system is necessary. Fire suppression for the Unit 1 auxiliary transformer, the Unit 1 interbus transformers and the Unit 2 interbus transformers consists of a deluge water spray system that is activated automatically by a signal from the heat detectors located at each transformer.

Fire barriers are provided between phases of the main transformer and on the east and west sides of the unit auxiliary transformer. Each transformer is surrounded by a curb to contain any oil leakage. Interbus transformers are separated from each other by fire barriers and are surrounded by a curb to contain any oil leakage. All building walls located within 50 feet of any of these transformers has a minimum fire resistance rating of 2 hours.

The concrete curb and fire barriers provide fire protection for the transformers. These are considered as structural bulk commodities, for details, refer to Section 2.4.4.

2.4.2.37 Transmission Towers

Description

The transmission towers are non-seismic category 1 structures that are located in the transmission station switchyard and the yard, isolated from seismic Category I structures. The transmission towers provide support for the power lines that are credited to provide offsite power for accident mitigation and recovery from a station blackout. The towers have been designed for worst case environmental conditions and tested beyond the governing national electric safety code requirements. The analysis and testing to this code shows that the structural failure of one tower will not result in the loss of the preferred power supply to the onsite electrical distribution system.

Functions (and scoping criteria, if intended function)

The structures are within the scope of license renewal because they provide support for nonsafety-related components that are relied upon to remain functional during or following a design basis event, and support components that are relied on to perform a function that demonstrates compliance with the regulations for station blackout.

The transmission towers have the following intended functions for 10 CFR 54.4 (a)(2) and (a)(3) [Reference 1.3-1]:

- Provide support for nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]
- Supports equipment credited for recovery from station blackout (10 CFR 50.63 [Reference 1.3-7]). [10 CFR 54.4(a)(3)]

References

UFSAR: 3.8.4 / 3.9.1.2.6.g / 8.2.1 / 8.2.2.1.c / Figure 1.2-2 / Figure 8.2-3

2.4.2.38 Valve Support Slabs

Description

The valve support slabs are non-seismic Category I buried structures that are located under fire protection water valves. The valve support slabs provide support for the valves.

Functions (and scoping criteria, if intended function)

The structures are within the scope of license renewal because they are relied on to perform a function that demonstrates compliance with the regulations of fire protection.

The Valve Support Slabs have the following intended functions for 10 CFR 54.4 (a)(3):

- Supports equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48) [Reference 1.3-7] [10 CFR 54.4 (a)(3)].

References

None

2.4.2.39 Water Treatment Building

Description

The water treatment building is a two-story structure. The building is located on the Unit 1 side of the plant. It is bounded by the turbine building on the east; the north, south and west walls are exposed. The water treatment building houses process equipment required to convert raw water into the various grades of water used in the plant. For fire hazards analysis, this entire two-story building is considered a fire area.

The east wall, shared with the turbine building, is constructed of drywall and has a 3-hour fire resistance rating. The north, south and west walls are exterior walls constructed of metal siding. The roof is of steel frame and metal deck construction with roofing that meets Factory Mutual (FM) Class I requirements. Doorways in the east wall are equipped with Class A fire doors. Other penetrations in this wall are sealed to provide a 3-hour fire resistance rating. No safe shutdown equipment is located in the water treatment building.

The objective for this fire area is to prevent fire within the water treatment building from endangering the ability to safely shut down the plant. This objective is achieved since this building has a low fire loading and is remote from safe shutdown equipment in other buildings.

The water treatment building houses components within the scope of license renewal (e.g., a flapper valve located in the sludge holding sump within the building which prevents back flow into the DG building oil interceptor tank).

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection, and the structure contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The water treatment building has the following intended functions for 10 CFR 54 [(a)(2)] and [(a)(3)] [Reference 1.3-1]:

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected (external flooding mitigation). [10 CFR 54.4(a)(2)]
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) [Reference 1.3-7]. [10 CFR 54.4(a)(3)]

References

UFSAR: Appendix 9A.4.10

License Renewal Drawing:

Perry LR Site Map

Notes:

1. Roof scuppers present on various Unit 2 buildings have been included in the new flooding models for the site. They are credited in maintaining roof water levels on various buildings, both safety and non-safety related.

2. Structural bulk commodities located within all the in-scope structures are described in Section 2.4.4.

Component Types Subject to Aging Management Review

Table 2.4.2-1 lists the component types that require aging management review and their intended functions.

Table 3.5.2-2, Structures – Turbine Building and Associated Structures, Process Facilities, and Yard Structures – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.4.2-1
Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures Component Types Subject to Aging Management Review

Component Type	Intended function
Beams, columns, floor slabs and interior walls	EN, FB, MB, SPB, SNS, SRE, SSR, FLB, SHD
Control room ceiling support system	SNS
Crane rails	SNS
CST dike and instrument missile shield	EN, MB, SNS, SSR
Diesel fuel tank maintenance structures	EN, MB, SNS, SRE, SSR
Diesel fuel unloading structure	SSR, FLB, MB
Duct banks	EN, SNS, SRE, SSR
Exterior walls	EN, FLB, MB, SNS, SPB, SRE, SSR
Exterior walls (below grade)	EN, FLB, SNS, SPB, SRE, SSR
Foundations, including caissons and porous concrete	EN, SNS, SRE, SSR

Component Type	Intended function
Fuel handling building crane	SNS, SSR
Fuel handling building platform and rails	SNS, SSR
Fuel pool liner plates and gates	EN, SPB, SSR
Manholes	EN, SRE, SSR
Masonry walls	SNS, SRE
Masts (Lighting)	SNS
Metal siding	SNS, SRE, EN
Missile Protection (Concrete and Steel)	SNS, SRE
Monorails	SNS, SRE
Pump well liners	EN, SSR
Railroad Bridge Concrete Pier and Girder Superstructure	FLB, SRE, SSR, SNS
Roof decking	FLB, SRE
Roof hatches	EN, FLB, MB, SNS, SSR
Roof slabs	EN, FLB, MB, SNS, SPB, SRE, SSR
Scuppers (Fuel pool)	SNS, SSR
Scupper Covers (Fuel Pool)	SNS, SSR
Scuppers (Roof)	SNS, SSR
Scupper cover (Roof)	SNS, SSR
Service water valve pit	SSR
Structural steel: beams, columns, plates	EN, MB, SNS, SRE, SSR
Sump liners	SNS, SRE, SSR
Sumps	SNS, SRE, SSR
Thrust blocks	SRE, SNS
Transmission towers	SRE
Valve support slabs, buried	SRE
Windows	FLB

2.4.3 WATER CONTROL STRUCTURES

The following structures are included in this review:

- Emergency Service Water (ESW) Pumphouse
- ESW Intake and Discharge (Alternate Intake) Tunnels including Ice Protection Caissons, Intake Structures, and Discharge Structure
- ESW Swale, and
- Major and Minor Streams

Descriptions

2.4.3.1 Emergency Service Water Pumphouse

Description

The emergency service water pumphouse (ESWPH) is a single story reinforced concrete structure, rectangular in plan, located between the nonsafety-related service water pumphouse (SWPH) and the nonsafety-related discharge tunnel entrance structure. It is an isolated structure located north of the main plant area with the SWPH as the closest building. The five-foot thick foundation mat is placed on one foot of porous concrete which is founded on chagrin shale at approximately elevation 531 feet. The structure has a reinforced concrete floor at elevation 586 feet 6 inches, which supports the pumps and screens. Above this floor an overhead crane is supported on steel girder rails which bear on reinforced concrete wall pilasters. Above that is a 2-foot thick reinforced concrete roof supported by steel girders spanning the width of the building. Penetrating through the foundation mat are the 10-foot diameter riser shafts from the emergency and alternate emergency intake tunnels, which supply the ESWPH with water from Lake Erie, the ultimate heat sink. Below the floor at elevation 586 feet 6 inches, the ESWPH is divided into compartments that are separated by means of reinforced concrete walls. During normal operation, lake water will be supplied to the ESW pumps through the intake tunnel. Should the intake tunnel become obstructed, an alternate source of lake water is available through the discharge tunnel. Under normal operating conditions, the discharge tunnel is isolated from the ESWPH by means of motor operated sluice gates. During an emergency, these gates will be opened to supply the necessary lake cooling water to the ESW pumps.

The concrete floor and roof slabs, as well as the concrete walls of the ESWPH structure have been designed to withstand local seismic accelerations; those below ground level and submerged in water are designed to resist the forces due to sloshing earthquake effect. The walls and floors below ground level retaining the backfill are designed to resist the dynamic (earthquake) soil pressure.

The shell of the structure (exterior above ground walls and the roof) were designed for tornado and missile loads. Further, the exterior walls below grade level were checked for the extreme environmental loads of the water table to grade. A 10-foot diameter cross tie tunnel between the Discharge Tunnel and the ESWPH is provided as a redundant water supply for the emergency service water pumps. The ESWPH includes a porous concrete blanket beneath the foundation base mat, extending vertically up along the exterior building walls. For fire hazards analysis, the ESWPH is divided into two fire areas and two fire zones.

This building houses pumps and associated equipment required to supply cooling water for safe shutdown systems. One area of the ESWPH houses the motor driven fire pump and equipment for the ESW system, including ESWPH traveling screens/motors, screen wash pumps, ESW pumps, discharge strainers, and associated control equipment. The ESWPH also houses nonsafety-related equipment that are within the scope of license renewal, e.g., portable water hose connections, eyewash and safety shower, flow elements and test isolation valves and tubing that provide a leakage boundary, failure of which may result in spatial interaction or spraying/wetting of safety-related equipment.

Walls, floor and ceiling are constructed of reinforced concrete. Access to the area is provided from the outside by doors at grade. The northeast corner of the ESWPH houses the diesel driven fire pump, control panel, diesel engine, and diesel fuel oil tank in the fire service room. Room walls, floor and ceiling are constructed of reinforced concrete. Interior walls have a 3-hour fire resistance rating and are equipped with Class A fire doors. The walls and ceiling have 3-hour fire resistance ratings (except for a 2 ft by 2 ft hatch in the ceiling, which is not required to be fire rated).

The ESWPH also provides storage of FLEX pumps and other miscellaneous equipment. Perry's FLEX lake water pumps have been pre-deployed in this building.

Interim shoreline protection near the ESWPH structure has been installed since 1983. In 2015, as part of the diversion stream installation, an armor stone revetment was installed at the outfall of the diversion stream. The armor stone revetment protects approximately 100 feet of shoreline.

The Interim Shoreline Protection is not credited or relied upon to protect any safety-related SSC since periodic monitoring assures sufficient margin exists in maintaining the minimum distance from toe/crest of bluff to the ESWPH structure. If the shoreline retreat becomes threatening to the safety-related structures, the shoreline will be protected by a suitable permanent construction that will protect the face and toe of the bluff. Final design and permit applications for the shoreline permanent protection construction will be initiated when the lake shoreline (toe of bluff) has receded to a point 250 feet away from the closest safety class structure [ESWPH].

Functions (and scoping criteria, if intended function)

The structure is within the scope of license renewal because it contains safety-related and nonsafety-related components that are relied upon to remain functional during or following a design basis event, because it contains components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection, anticipated transients without scram, and station blackout. The structure also contains nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The ESW pumphouse and associated structures have the following intended functions for 10 CFR 54.4 (a)(1), (a)(2), and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related equipment and within the scope of license renewal. [10 CFR 54.4(a)(1)]
- Provide access to the ultimate heat sink to the emergency service water system for mitigation of design basis events. [10 CFR 54.4(a)(1)]
- Provides missile (internal or external) barrier. [10 CFR 54.4(a)(1)]
- Sluice gates provide a pressure boundary function to isolate the ESW forebay from the discharge tunnel. [10 CFR 54.4(a)(1)]
- Provide shelter, support and protection for nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- House equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48 [Reference 1.3-7]), anticipated transients without scram (10 CFR 50.62 [Reference 1.3-7]) and for station blackout (10 CFR 50.63 [Reference 1.3-7]). [10 CFR 54.4(a)(3)]

References

UFSAR: 2.2.3.1.4 / 2.4.1.2 / 2.4.5.3.1 / 2.4.5.4 / 2.4.5.5.1.1 / 2.4.5.5.9 / 2.4.11.6 / 2.5.1.2.1.2 / 3.8.4.1.9 / 3.8.4.1.10 / 3.8.4.1.11 / 3.8.4.4.1 / 9.2.1.3 / 9.2.5.3 / Appendix 9A.4.6 / Appendix 9A.4.6.1.1 / Appendix 9A.4.6.2.1 / 2.4.5.5.9 / 15.7.3.5.f / Appendix 1B, License Commitment 1 / Figure 1.2-16

License Renewal Drawing:

Perry LR Site Map

2.4.3.2 ESW Intake and Discharge (Alternate Intake) Tunnels Including Ice Protection Caissons, Intake Structures and Discharge Structure

Description

Intake and Alternate Intake (Discharge) Tunnels

Cooling water for PNPP is obtained from Lake Erie, carried to the plant site through a greater than 2,800 feet long, 10-foot diameter intake tunnel located in the underlying bedrock. The water is then returned to the lake through a similar discharge tunnel approximately 2,000 feet long. Two 10 foot diameter tunnels, each only a few hundred feet long, intersect the main cooling water tunnels near the shore facilities. Their only purpose is to draw cooling water for the ESWPH, either from the intake or the discharge tunnel.

The portions of the tunnels that supply water to the emergency service water cooling system, as well as the intake structure, discharge tunnel and ESWPH, are designed as seismic category I structures. All safety-related emergency service water discharge structures and piping are either tornado missile protected or have been evaluated for the probability of tornado missile strikes.

Intake Structure

Located approximately 2,600 feet offshore, each of the two independent intake structures is a submerged steel plate multiport structure, circular in plan, resting on a working mat founded in shale bedrock at a minimum depth of four feet below the bottom of Lake Erie. Each intake is composed of an independent 36-foot diameter circular intake head that is connected to a six-foot diameter vertical down-shaft which conveys the cooling water to the underground ten-foot diameter intake tunnel. Each of the two intake heads is provided with a horizontal circular velocity cap and vertical inflow ports around the periphery.

The Intake Structure is a safety-related structure as it supplies water to both the ESWPH and the SWPH. The portions of the tunnels that supply water to the emergency service water cooling system, as well as the intake structure, discharge tunnel and ESWPH, are designed as seismic category I structures.

Discharge Structure

The discharge structure is located approximately 1,650 feet offshore. The offshore discharge structure consists of a submerged 3-foot diameter steel diffuser nozzle encased in a 17-foot diameter protective reinforced concrete ice protection caisson founded in chagrin shale a minimum of 7 feet below lake bottom. A six-foot diameter riser shaft connects the 10-foot diameter underground discharge tunnel to the nozzle.

Ice Protection Caissons

Each intake structure is surrounded by 10 vertically-reinforced concrete ice protection caissons, which are placed in a 70-foot diameter circle around each intake. The caissons are six feet in diameter with the exception of two caissons around the No. 1 Intake Structure, which are seven feet in diameter due to the poorer foundation conditions of weathered and/or fractured shale at their locations. All caissons are founded in chagrin shale a minimum of 12 feet below lake bottom. The embedment depth of each caisson varies between 12 and 20.8 feet depending on the depth of weathered shale at each location.

The Ice Protection Caissons act as a barrier to any floating ice island which could block ports of the intake structures. For the very unlikely case where complete blockage of the intake structures would occur, water for the emergency service water system will be drawn from the discharge tunnel.

Functions (and scoping criteria, if intended function)

The structures are within the scope of license renewal because they are relied upon to remain functional during or following a design basis event, because they contain components that are relied on to perform a function that demonstrates compliance with the regulations for fire protection, anticipated transients without scram, and station blackout.

The water control structures associated with the ESW intake and alternate intake tunnels have the following intended functions for 10 CFR 54.4 (a)(1) and (a)(3) [Reference 1.3-1]:

- Provide shelter, support and protection for safety-related equipment. [10 CFR 54.4(a)(1)].
- Provide access to the ultimate heat sink to the emergency service water system for mitigation of design basis events, including station blackout (SBO) and anticipated transients without scram (ATWS). [10 CFR 54.4(a)(1)] and [10 CFR 54.4(a)(3)]
- Provide access to the ultimate heat sink for the fire protection system. [10 CFR 54.4(a)(3)]

References

UFSAR: 2.2.2.4 / 2.2.3.1.5 / 2.4.5.4 / 2.4.7.2 / 2.4.8.1 / 2.4.8.2 / 2.4.8.2.1 / 2.4.11.6 / 3.1.2.4.15.1 / 3.8.4 / 3.8.4.1.9 / 3.8.4.1.10 / 3.8.4.1.11 / 9.2.1.2 / 9.2.5.3 / Appendix 1B, License Commitment 1 / Figure 1.2-16 / Figure 2D-3

2.4.3.3 ESW Swale / Major Stream and Minor Stream/Diversion Stream / Diversion Stream Berm

Description

ESW Swale

Should the normal ESW supply from the intake tunnel be interrupted, sluice gates open automatically upon receiving a low water level signal from the ESWPH forebay, allowing water from the discharge tunnel to flow into the forebay and supply the ESW system. Upon indication on a control room panel that the sluice gates are open, manual valves will be administratively closed to prevent warm ESW from dumping to the discharge tunnel. Instead, the ESW system will discharge via standpipes to the yard outside of the Auxiliary Building. At this location an overland swale is provided to carry the flow from the Auxiliary Building area, between the cooling towers, to the Remnant Minor Stream's engineered channel on the east side of the plant. This water then flows in the channel over the sediment control dam and ultimately enters Lake Erie at the shoreline.

Major Stream

The major stream has a drainage basin of 7.44 square miles and runs northwestward within 1,000 feet of the southwest corner of the plant. If a probable maximum flood (PMF) is experienced, the stream will be contained within its drainage basin with no site impact except for the overtopping of the crossing at the plant main access road, which would temporarily prevent road access. Topography along the plant-side bank of the major stream will preclude flooding of the site by the PMF, allowing the plant to continue uninterrupted operation. The major stream culvert, underlying the plant's main access road, is assumed to remain functional with the major stream's PMF analysis.

Remnant Minor Stream/Diversion Stream

The minor stream borders the plant area to the east and south. The minor stream's natural watercourse discharges into an engineered channel located to the east of the facility (called the diversion stream). The diversion stream was installed in 2015 and diverts streamflow away from the original engineered channel portion of the minor stream; a large fill area at the base of the remnant minor stream channel forces streamflow into the diversion stream. The original engineered channel, now referred to as the remnant minor stream, functions as a swale pathway for the local intense precipitation (LIP) domain rather than as a traditional stream or river. The two channels run parallel to each other on the east side of the plant and are separated by an earthen embankment structure named the diversion stream berm (these channels do not communicate). The drainage area of the diversion stream is 0.6 square mile and includes the drainage basin of the natural minor stream watercourse. The drainage area for the remnant minor stream is limited to only a portion of the LIP domain. The diversion stream and associated berm prevent the PMF flow from reaching any plant safety-related equipment.

The remnant minor stream channel outfall to the lake was constructed using 96-inch diameter corrugated metal pipe installed over a layer of 500 to 8,000-pound dumped stone riprap. The pipe was terminated at the sheet piling protection installed along the lake shoreline in front of the plant site. An inline spillway structure at the outfall of the Diversion Stream channel was constructed to accommodate conveyance of flow to Lake Erie. Improvements include installation of an armor revetment structure to provide shore protection within the location of the spillway.

Diversion Stream Berm

The diversion stream berm is installed between the Remnant Minor Stream channel and the Diversion Stream. The berm is constructed using the compacted excavation spoils from the Diversion Stream channel. The berm is nonsafety-related and not seismically qualified. Berm failure is evaluated and included for flooding considerations. Periodic inspection of the berm is performed to ensure long-term stability and reliability of the topographic feature including inspection for settlement and piping formation.

Functions (and scoping criteria, if intended function)

The structures are within the scope of license renewal because they are relied upon to remain functional during or following a design basis event. The integrity of these structures is necessary to preclude spatial interactions that could affect safety-related functions.

The ESW swale, major stream, remnant minor stream, diversion stream and diversion stream berm structures have the following intended functions for 10 CFR 54.4 (a)(2) [Reference 1.3-1]:

- Provide flood protection for safety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]

References

UFSAR: 2.4.2.2 / 9.2.1.2 / 2.4.5.5.8 / 2.5.6

2.4.3.4 Oil Interceptor Tanks (OITs)

Description

The purpose of the OITs is to collect the oil in case of a spill in the diesel generator building or other plant buildings. The oil will flow through pipes to these tanks and get collected in the tank. There are five OITs that are constructed of reinforced concrete walls, base slab and top slab. A manhole cover provides access to these tanks that are sealed for flood protection. Each tank has 2-inch diameter vent lines that protrude 2-foot above the grade. Based on the flooding analysis, the vent lines are sufficiently above the flood plane to prevent floodwater ingress. However, failure of these vent lines and the manhole covers will result in floodwater ingress to the tanks and may eventually flood the diesel generator building.

Functions (and scoping criteria, if intended function)

The structures are within the scope of license renewal because they are nonsafety-related components whose integrity is necessary to preclude spatial interactions that could affect safety-related functions.

The oil interceptor tanks have the following intended functions for 10 CFR 54.4 (a)(2) [Reference 1.3-1]:

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]

References

UFSAR: None

2.4.3.5 Exterior Flood Protection

Description

Flood Barriers at the entrance of various plant buildings (Passive and Deployable):

The flood protection barriers at PNPP include passive (permanent or normally installed) barriers and deployable incorporated barriers. Concrete and aluminum flood walls are installed at or near the building environmental interface for nonsafety-related buildings. For safety-related buildings, credit is taken for flood mitigation via the existing concrete exterior walls. The plant doors have flood barriers installed at the doorways to provide a seal to prevent water from entering building structures. The barriers consist of permanently installed steel end channels that are attached to the building structure and allow for the installation of aluminum stop logs with seals to provide the flood protection. These barriers are sized for the effects of the probable maximum precipitation (PMP) event over the localized intense precipitation (LIP) domain. Select plant doorways are also provided with ramps/curbs which provide passive protection for precipitation events up to and including the standard project storm (SPS); in some cases, door barriers (stop logs) are normally deployed and administratively controlled for SPS protection.

Incorporated barriers along the structure-environment interface of nonsafety-related structures, such as concrete and aluminum wall panels, constitute permanent, passive protection (“hardened protection” per RG 1.59) to ensure no gross leakage occurs through nonsafety-related plant exterior walls (Unit 1 and Unit 2).

Operator actions are limited to the deployment of removable incorporated barriers in the form of aluminum flooding stop logs. The requirements and guidance for this action is incorporated into plant off-normal instructions.

Flood protection features used at Perry are generally nonsafety-related.

Flood Barriers around safety-related Electrical Manholes

The electrical manholes are reinforced concrete boxes used as distribution points for cable routing. Permanent steel curbing is installed around the hatches of four safety-related electrical manholes (containing safety-related cables) to protect against flooding.

Roof features to accommodate Probable Maximum Precipitation (PMP)

Most of the site structures include parapets that result in the accumulation of rainwater on building roofs. Various roof features exist (such as roof drains, scuppers, and removed parapets) to create a scenario in which all roofs remain structurally sound during a design basis PMP event. Additionally, these features allow water level margin on roofs of various plant buildings to accommodate a beyond design basis (BDB) precipitation event.

Plant Storm Drain and Roof Drain Systems

The storm drain system consists of three subsystems, East, West, and South. Most of the storm drain conduit material is corrugated metal pipe (CMP) with paved invert. A much smaller fraction of the conduit material is reinforced concrete pipes (RCP) as specified on the various drawings. To account for uncertainty associated with pipe capacity reduction possibly due to sediment/debris, the storm drainpipe segments are analyzed at 90 percent capacity.

The plant storm drain system is credited in mitigating the effects of the local intense precipitation event as well as lesser (non-PMP) precipitation events. The storm drain system is nonsafety-related. In addition, the plant roof drain system is also included in the system modeling. The roof drain system is hydraulically coupled to the storm drain system; therefore, to avoid potential non-conservatisms related to hydraulic head and capacity reduction, the roof drain system is considered part of the storm drain system. The overall flooding analysis includes crediting the nonsafety-related storm drain system and nonsafety-related permanent and temporary incorporated barriers (flood panels) to collectively mitigate the effects of a design basis local intense precipitation event.

Structural Functions (and scoping criteria, if intended function):

The structures are within the scope of license renewal because they are nonsafety-related components whose integrity is necessary to preclude adverse effects from external flooding that could affect safety-related functions.

The Exterior Flood Protection structures have the following intended functions for 10 CFR 54.4 (a)(2) [Reference 1.3-1]

- Mitigate the effects of external flooding. [10 CFR 54.4 (a)(2)]

References:

License Amendment 200

Notes:

1. For the purposes of aging management review, the structural elements associated with the flood barriers (passive and deployable), scuppers, and piping for plant roof and storm drain systems are considered structural bulk commodities and as such are addressed under Structural Bulk Commodities.

2. Structural bulk commodities located within all the in-scope structures are described in Section 2.4.4.

Component Types Subject to Aging Management Review

Table 2.4.3-1 lists the component types that require aging management review and their intended functions.

Table 3.5.2-3, Structures – Water Control Structures – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.4.3-1
Water Control Structures
Component Types Subject to Aging Management Review

Element / Component Type	Intended function
Beams and columns	EN, HS, SNS, SSR,SRE
Caissons, ice protection	SSR
Culvert, major stream	SNS, FLB
Diversion Stream	FLB, SNS
Diversion Stream Berm	FLB, SNS
ESW Pumphouse Crane	SNS
Exterior walls above grade	EN, HS, MB, SNS, SSR, SRE, FLB
Exterior walls below grade	EN, HS, SNS, SSR, SRE
Floor slab	EN, HS, MB, SNS, SRE, SSR
Foundation	EN, HS, SNS, SSR
Intake/discharge structure	HS, SRE, SSR
Intake/discharge tunnel	HS, SRE, SSR
Interior walls	EN, HS, MB, SNS, SRE, SSR, FB
Major and minor stream beds	SNS
Major Stream	FLB, SNS
Remnant Minor Stream	FLB, SNS
Roof Drains	FLB
Roof Hatches	EN, MB, SNS, SSR, FLB, SRE
Roof slab and ceiling of DDFP Room	EN, FB, MB, SNS,SRE,FLB
Roof slabs	EN, MB, SNS, SSR,FLB, SRE, FB
Structural steel, beams, columns, plates including sluice gate frames	EN, HS, SNS, SSR,SRE
Swale	FLB, SNS

2.4.4 STRUCTURAL BULK COMMODITIES

Description

Bulk commodities subject to aging management review are structural components or commodities that perform or support intended functions of in-scope systems, structures and components (SSCs). Bulk commodities unique to a specific structure are included in the review for that structure. Bulk commodities common to in-scope SSCs (e.g., anchors, embedments, pipe and equipment supports, instrument panels and racks, cable trays, conduits, etc.) are addressed in this section as well as seismic II/I supports. Components (including snubbers, struts and their associated passive components, include passive components associated with spring cans, and constant and variable spring cans).

Bulk commodities evaluated in this section are designed to support both safety-related and nonsafety-related equipment during design basis events. Bulk commodities subject to aging management review are structural components or commodities that perform or support intended functions of in-scope SSCs.

Note: Piping is considered a mechanical component and their material descriptions are addressed in the individual mechanical aging management reports. However, pipe plugs and storm drain piping are considered as bulk commodities.

Functions (and scoping criteria, if intended function)

The Bulk Commodities structural group is within the scope of license renewal because it contains safety-related components that are relied upon to remain functional during or following a design basis event it contains nonsafety-related components whose failure could prevent accomplishment of a safety-related function, and it is relied on to perform a function that demonstrates compliance with the regulations for fire protection, anticipated transient without scram, and station blackout.

Bulk commodities are structural components that support the various intended functions performed by the structures in which they are located. These functions for 10 CFR 54.4(a)(1), (a)(2), and (a)(3) [Reference 1.3-1] include the following:

- Provide support, shelter and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal. [10 CFR 54.4(a)(1)] [10 CFR 54.4(a)(2)]

- Insulation may have the specific intended functions of (1) maintaining local area temperatures within design limits or (2) maintaining integrity such that falling insulation does not damage safety-related equipment. [10 CFR 54.4(a)(1)] [10 CFR 54.4(a)(2)]

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]

- Provide support and protection for equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48 [Reference 1.3-7]), for anticipated transients without scram (10 CFR 50.62 [Reference 1.3-7]), and for station blackout (10 CFR 50.63 [Reference 1.3-7]). [10 CFR 54.4(a)(3)]

References

UFSAR: 3.5.3, 3.6.2.3.5.2, 3.8.4.1.13 / 3.8.4.1.14 /3.8.4.1.15 / 3.8.4.1.16 / 3.9.3.4.4 / 3.9.3.4.6 / 6.1.2 / 6.2.2.2 / 8.3.2.1.2.3 / 9.1.2.2.1 / 9.1.2.3 / 9.3.3.2.1 / Appendix 9A.4.5.1.1.1 / Figure 3.6-61 / Table 3.5-5 / Table 9.5-1

Component Types Subject to Aging Management Review

Table 2.4.4-1 lists the component types that require aging management review and their component-level intended functions.

Table 3.5.2-4, Structures – Bulk Commodities – Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.4.4-1
Bulk Commodities
Component Types Subject to Aging Management Review

Component Type	Intended function
Abandoned piping for System E32 at various penetrations	SPB
Aircraft Cables	SNS
Anchor Bolts	SNS, SRE, SSR
Anchorage/Embedments	SNS, SRE, SSR
Bolting, (Bolts, U-bolts, Studs, Nuts, Washers) including: ASME Class MC Supports ASME Class 1, 2, 3 bolting for in- scope piping, ductwork, components and supports; Non-ASME bolting for in- scope piping, ductwork, components, and supports, including electrical applications; Structural bolting, including electrical Nuts/washers for in-scope anchorage/ embedments	SSR, SNS, SRE
Base Plates	SNS, SRE, SSR
Battery Racks	SNS, SRE, SSR
Bird Screens	SNS, SRE

Component Type	Intended function
Cable Trays	SNS, SRE, SSR
Cable Trays Supports	SNS, SRE, SSR
Cask Pit Pool Waste Storage Rack	SHD, SNS
Catch Basins and Catch basin covers	FLB, SNS
Components (including Snubbers, Struts and their associated passive components, etc.) and Piping Supports	SNS, SRE, SSR
Component (including Snubbers, Struts and their associated passive components, etc.) and piping supports (ASME Class 1,2, and 3)	SNS, SRE, SSR
Concrete Fire Barrier	FB
Conduit Caps	FLB
Conduit Supports	SNS, SRE, SSR
Conduits	SNS, SRE, SSR
Containment Isolation Dampers for U2 Containment Isolation (2M14F0040, 2M14F0085, 2M14F0200)	FB
Cranes, Trolleys, Monorails and Hoists (evaluated as structural components or commodities of the structures in which they are located)	SNS, SRE, SSR
Dampers and louver housings and fixed louvers	SNS, SRE, SSR, FB
Diesel Exhaust Hallway Insulation Bolting	EN, SSR, SNS
Electrical and Instrument Panels, Enclosures and Junction Boxes	SNS, SRE, SSR
Equipment Pads/Foundations	SNS, SRE, SSR, FLB
Expansion Joints	FLB, SSR, EN, EXP
Fire Damper Housing	SRE, SNS, FB
Fire Dampers (2M15) that provide passive fire protection barriers between IB and Unit 2 Annulus	SRE, SNS, FB
Fire Doors and Barriers	FB, SRE
Fire Hose Reels	SRE
Fire Proofing	FB, SRE

Component Type	Intended function
Fire Stop	FB, SRE
Fire Wrap	FB, SRE
Flapper Valve (Diesel Generator Room)	FLB
Flashing	SNS, SRE, SSR
Flood Curbs	FB, FLB, SNS
Flood, Pressure and Specialty Doors	EN, FLB, MB, SPB, SSR
Floor grating (including studs, wire rope and connectors)	SNS
Fuel and Containment Pool Liner, Skimmer Plates and Scupper Boxes	DF, SSR
Fuel Handling Platform	SNS, SSR
Fuel Prep Machine	SNS, SSR
General Purpose Grapple	SNS, SSR
HVAC Duct	SNS, SSR
HVAC Duct Supports	SNS, SSR
Instrument and Control Supports	SNS, SRE, SSR
Instrument line supports	SSR
Instrument Racks, Frames and Tubing Trays	SNS, SRE, SSR
Insulation (including EDG Exhaust Missile Barrier Interior Hallway insulation)	SNS
Insulation Jacketing	SNS
Kellem's Grips	SRE
Lifting Lugs at Manholes and other various locations	SSR, SNS
Louvers and Dampers, including Unit 2 M49 Fire Dampers	SRE, SNS, FB
Manway, Hatches, Manhole/Manway Covers and Hatch Covers	EN, FB, FLB, MB, SNS, SPB, SRE, SSR
Metallic (mirror) Insulation	SNS
Missile Shields	MB
New Fuel Inspection Stand	SSR
Non-ASME bolting for in-scope piping, ductwork, components, and supports, including electrical applications	SSR, SNS, SRE

Component Type	Intended function
Nuts/washers for in-scope anchorage/embedments	SNS, SRE, SSR
Oil Interceptor Tanks (Walls, Base Slab, Top Slab, Vent Lines and Manhole Covers)	FLB
Penetration Sealant (fire) Missile shields	EN, FB, FLB, SNS, SPB, SRE
Penetration Sealant (flood, radiation)	EN, FLB, SNS, SPB, SRE, SHD
Penetration Sealant (flood)	EN,FLB,SNS
Penetration Sleeve Seal Plates (mechanical/electrical not penetrating primary containment boundary)	FLB, SNS, SSR
Penetration Sleeves (mechanical/electrical not penetrating primary containment boundary)	FLB, SNS, SSR
Pipe Plug	FLB
Pipe Whip Restraints	EN, SNS, SSR
Protection tubes associated with suppression pool temperature elements	SSR, SNS
Radiant Barrier	SSR, SNS, EN
Radiant Energy Shield	FB, SRE
Rain Guard	SNS
Refueling Platform	SSR, SNS
Roof Drain Strainers	FLB
Roof Membrane	EN, SNS
Roof Scuppers, Roof Parapet gaps (Concrete)	FLB, EN, SNS
Roof Scuppers, Roof Parapet gaps (Steel)	FLB, EN, SNS
Sanitary Fixtures inside the Control Room	EN,SPB

Component Type	Intended function
Scaffold (Long Term)	EN, SSR, SNS
Seals and Gaskets (Doors, Manways and Hatches)	FLB, SPB, SSR
Seismic isolation joint seals and gaskets (doors, manways and hatches)	FB, SSR
Seismic Isolation Joint	FB, SSR
Shielding (Long Term)	SHD, SNS
Sliding Supports (including lubrite pads)	SSR
SRV Tailpipe Penetration Boot Seals	EN, FB, FLB, SPB, SNS
Stairway, Handrail, Platform, Grating, Decking and Ladders	SNS
Storm Drains (Steel, Polymer and Concrete)	FLB, SNS
Structural bolting	SNS, SRE, SSR
Support Members: Welds; Support anchorages to building structure	EN, SNS, SSR, SRE
Support Pedestals	SNS, SRE, SSR
Tefzel Ties	SNS
Tornado depressurization duct blank-off plates	SNS, SSR
Tornado Doors	SSR, SRE, FB
Waterproofing Membranes	EN, FLB
Water Stops	FLB
Wood Clamps (Maple)	SSR, SNS, SRE

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROL SYSTEMS

The determination of electrical and instrumentation and control (I&C) systems within the scope of license renewal is made through application of the process described in Section 2.1. The results of the electrical and I&C systems scoping review are contained in Section 2.2.

Section 2.1 also provides the methodology for determining the components within the scope of 10 CFR 54.4 [Reference 1.3-1] that meet the requirements contained in 10 CFR 54.21(a)(1). The electrical and I&C components that meet these screening requirements are identified in this section. These identified components require an aging management review (AMR) for license renewal.

Components that support or interface with electrical and I&C components, for example, instrument racks, panels, cabinets, cable trays, conduit, and their supports (including foundations for outdoor equipment), are included in the civil-structural assessment documented in Section 2.4.

Information describing the electrical and I&C systems can be found in the Updated Final Safety Analysis Report (UFSAR) [Reference 1.3-6] Chapter 7 for I&C systems, UFSAR Chapter 8 for electrical power systems, and UFSAR Section 8.2 for the station offsite power system. UFSAR Appendix 15.H, Station Blackout (SBO), provides the requirements regarding Station Blackout coping. UFSAR Appendix 9A.4, Fire Hazards Analysis, provides requirements regarding fire protection for electrical and I&C components. UFSAR Chapter 3 provides requirements regarding environmental qualification for electrical and I&C components. USAR Appendix 15C provides the licensing basis for anticipated transients without scram (ATWS) and USAR 7.6.1.12 describes the design features for ATWS.

2.5.1 ELECTRICAL AND I&C SCREENING PROCESS

The screening process identifies the electrical component commodity groups that are subject to AMR for in-scope plant systems that include electrical and I&C components. Electrical component commodity group identification is done in accordance with the requirements of 10 CFR 54.21(a) [Reference 1.3-1] and the guidance of NEI 95-10 [Reference 1.3-3], Appendix B. Electrical components that are active and electrical components that are replaced on a specified time schedule are not subject to AMR. Only long-lived, passive components that perform a license renewal intended function are subject to AMR.

2.5.2 Application of Screening Criteria 10 CFR 54.21(a)(1)(i) to Electrical and I&C Component Commodity Groups

The screening determination with respect to the passive criterion is taken directly from NEI 95-10 [Reference 1.3-3]. Appendix B of NEI 95-10 delineates which commodity groups are active and which are passive. The active components are excluded from further review, by the direction of 10 CFR 54.21(a)(1)(i) [Reference 1.3-1].

Specific Perry documents were reviewed to determine the applicability of the industry standard commodity groups (i.e., single-line drawings, maintenance rule functions, UFSAR [Reference 1.3-6] Chapter 7, Chapter 8, Appendix 9A.4, and electrical layout drawings, etc.). The screening review also evaluated the environmental qualification status of the electrical and I&C components. The screening review did not identify any additional commodity groups for evaluation.

2.5.3 Elimination of Component Commodity Groups with no License Renewal Intended Functions

The following electrical and I&C component commodity groups do not perform a license renewal function and are excluded from AMR, in accordance with 10 CFR 54.21(a)(1)(i) [Reference 1.3-1].

2.5.3.1 Uninsulated Ground Conductors

Uninsulated ground conductors limit equipment damage and provide personnel protection in the event of a circuit failure.

Uninsulated ground conductors are not safety-related and their failure cannot cause the loss of a safety-related function. They are not required for any fire protection commitment, and they are not part of the station blackout or anticipated transients without scram evaluations. They are not included in the environmental qualification (EQ) program. Uninsulated ground conductors are not relied upon in safety analyses or plant evaluations to perform any function consistent with the requirements of 10 CFR 54.4(a)(3) [Reference 1.3-1]. Therefore, uninsulated ground conductors are not within the scope of license renewal and are not subject to aging management review.

2.5.3.2 Metal-Enclosed Bus

Isolated Phase Bus at the Main Generator has no license renewal intended function. The in-scope bus components for the 13.8-kV and 4.16-kV electrical systems utilize insulated cable routed in raceway. There are no segregated phase or non-segregated phase metal enclosed bus at PNPP.

2.5.3.3 Cable Tie Wraps

Kellum grips are used in cable installation vertical risers greater than 20 feet. Kellum grips are a basket weave cable grip used to support the weight of the cables. They are in addition to tie wraps. Kellum grips and tie wraps are included as structural bulk commodities and are not included as electrical commodities.

Tie wraps are used in cable installations (in panels and raceway) to hold groups of cables together for restraint and ease of maintenance by keeping cable runs neat and orderly. There are no current license basis requirements for tie wraps at Perry. Tie wraps are not required to remain functional during and following design basis events. Tie wraps are not required for maintaining cable ampacity, ensuring the maintenance of minimum bend radius, or maintaining cables within vertical raceways. Tie wraps are not required for any seismic analysis.

2.5.3.4 Unit 2 Buildings

The PNPP Unit 2 Construction Permit has been withdrawn. The NRC issued a Safety Evaluation dated November 1, 2001 that addressed withdrawal of the Unit 2 construction permit and Unit 2 site stabilization. Some shared components are used to support Unit 1 operations and are located in some Unit 2 buildings.

Most components and commodities in the Unit 2 turbine building, the Unit 2 turbine power complex, and the Unit 2 auxiliary building do not perform an intended function and are not in scope. Those components and commodities that support Unit 1 operations with a license renewal intended function include:

- The Unit 2 startup transformer and the Unit 2 interbus transformer A (in the yard).
- Nonsafety-related 480V distribution panel F2A04 to support the Unit 2 startup transformer and the associated cable and raceway. This transformer provides preferred offsite power, supports GDC-17 [Reference 1.3-7] and supports station blackout recovery. These EIC components and commodities are located at the 620’-624’ elevation in the north area of the turbine building.
- The Unit 2 turbine power complex houses Unit 2 transmission and distribution components and commodities that support Unit 1 license renewal intended functions.
- Fire protection components and commodities for protection of the spaces and Unit 2 transformers are located in both the Unit 2 turbine building and the Unit 2 turbine power complex.
- The western portion of the Unit 2 auxiliary building contains cable and raceway to support the various Unit 2 components and commodities supporting Unit 1 functions.

The Unit 2 heater bay, off-gas, and reactor buildings contain no EIC components or commodities within the scope of license renewal.

2.5.4 APPLICATION OF SCREENING CRITERIA 10 CFR 54.21(A)(1)(II) TO ELECTRICAL AND I&C COMPONENT COMMODITY GROUPS

The 10 CFR 54.21 (a)(1)(ii) [Reference 1.3-1] screening criterion was applied to the specific commodities that remained following application of the 10 CFR 54.21 (a)(1)(i) criterion. 10 CFR 54.21 (a)(1)(ii) allows the exclusion of those commodities that are subject to replacement based on a qualified life or specified time period. Electrical commodities identified for exclusion by the criteria of 10 CFR 54.21 (a)(1)(ii) are electrical and I&C components and commodities included in the Environmental Qualification (EQ) Program. This is because electrical and I&C components and commodities included in the EQ Program have defined qualified lives and are replaced prior to the expiration of their qualified lives. No electrical and I&C components and commodities within the EQ Program are subject to aging management review in accordance with the screening criteria of 10 CFR 54.21 (a)(1)(ii). See Section 4.4 for the TLAA evaluation of the Environmental Qualification (EQ) of Electric Components program. The remaining commodities, all or part of which are not in the EQ Program or in excluded Unit 2 buildings, require aging management review and are discussed below.

2.5.5 ELECTRICAL AND I&C COMPONENT COMMODITY GROUPS REQUIRING AN AGING MANAGEMENT REVIEW

Table 2.5-1 provides the definitions of electrical intended functions used in this application for electrical commodities. The electrical and I&C component commodity groups that require AMR are listed in Table 2.5-2, along with their intended functions. Electrical and I&C component commodity groups that require an AMR are discussed in the following sections.

2.5.5.1 Non-Environmentally Qualified Insulated Cables and Connections

The non-EQ insulated cables and connections commodity group includes all in-scope electric power cables, control cables, and instrumentation cables that are not addressed by the EQ program, and those in-scope connections (e.g., splices, terminal blocks, electrical penetration assemblies, and electrical connectors) that are not addressed by the EQ program. Also included in this group are the metallic parts of electrical cable connections.

An insulated cable is an assembly consisting of one or more conductors (aluminum or copper) with a covering of insulation, and may include fillers and a jacket to cover the entire assembly. The assembly may also include a metallic shield. The jacket, filler, and metallic shield are not evaluated for the purposes of license renewal; the insulation is the only portion subject to evaluation.

Cable connectors are used to connect the cable conductors with other cables or with a variety of electrical devices (e.g., motors or instruments). Examples of connectors are compression fittings, fusion connectors (used primarily for uninsulated ground conductors), plug-in connectors, and terminal blocks (including fuse blocks).

Splices are used to connect cable conductors to penetration pigtails or to motor leads, and are also used to connect sections of cable during repair or replacement. Splices may also have been utilized during original cable installation.

A terminal block consists of an insulating base with fixed metallic points for landing wires (conductors) or for connecting terminal rings (lugs). Terminal blocks are installed in an enclosure such as a panel, control board, motor control center, terminal box, or other enclosure.

Electrical penetration assemblies are components utilized to carry electrical conductors through the Shield Building and Containment Vessel (via a canister-type configuration), while providing electrical continuity for the applicable circuits. The electrical penetrations consist of sealants, feed-throughs (the conductors), connections, plates and other support sub-components.

The function of insulated cables and connections is to provide electrical connection to specified portions of an electrical circuit to deliver voltage, current, or signals. Non-EQ insulated cables and connections are passive, long-lived components. Therefore, non-EQ insulated cables and connections meet the criteria of 10 CFR 54.21(a)(1) [Reference 1.3-1] and are subject to an AMR.

2.5.5.2 Fuse Holders (Not Part of Active Equipment)

Fuse holders are blocks of rigid insulation material with metallic clamps attached to the blocks to hold each end of the fuse. The clamps can be spring-loaded clips, or they can be bolt lugs.

A systematic review was performed to determine if there were any fuse holders that were in scope for Perry license renewal. The fuse holders evaluated for license renewal are those in passive, stand-alone applications. Fuse holders in active electrical panels (those containing active electrical components) are excluded. Based on review of Perry electrical drawings, fuse documentation, and other engineering documents, there are plant fuse holders that are not part of active equipment. These fuse holders are subject to aging management review. They provide backup fusing protection for the electrical penetrations.

2.5.5.3 Switchyard Bus and Connections, Transmission Conductors and Transmission Connectors

Switchyard bus is uninsulated, unenclosed, rigid electrical conductor used in plant switchyards and switching stations to connect two or more elements of an electrical power circuit.

The switchyard bus is connected to flexible connectors that are supported by insulators and ultimately by structural components such as concrete footings and structural steel.

The switchyard bus and connections provide electrical connection between the plant electrical system and the transmission grid to deliver voltage and current. Switchyard bus and connections are passive, long-lived components. Therefore, the switchyard bus and connections meet the criteria of 10 CFR 54.4(a)(3) [Reference 1.3-1] to recover from a station blackout and are subject to an AMR.

Transmission conductors are aluminum conductor steel reinforced (ACSR), stranded aluminum conductors wrapped around a steel wire core. They are uninsulated, high-voltage conductors used to carry loads in plant switchyards and in distribution applications. The connections are cast aluminum or galvanized steel, with stainless steel washers.

The section of transmission conductor within the scope of license renewal is located between the startup transformers and the plant switchyard. The in-scope transmissions conductors are shown in drawing 206-0010 LR (the conductor from the switchyard to the startup transformers).

The function of transmission conductors and connections is to provide electrical connection to specified portions of an electrical circuit to deliver voltage and current. Transmission conductors provide the supply of off-site power to the plant to mitigate accidents/transient and to recover from station blackout conditions. Transmission conductors and connections are passive, long-lived components. Therefore, the transmission conductors and connections meet the criteria of 10 CFR 54.4(a)(3) to recover from a station blackout and the expectations of NUREG 1800, Section 2.1.3.1.3 and are subject to an AMR.

2.5.5.4 High-Voltage Insulators

A high-voltage insulator is a component designed to physically support a high-voltage conductor and to separate the conductor electrically from another conductor or object.

Station post insulators are large and rigid and are used to support stationary equipment, such as short lengths of transmission conductors, switchyard bus, and disconnect switches. Strain insulators are used in applications where movement of the supported conductor is expected and allowed, including maintaining tensional support of transmission conductors between transmission towers or other supporting structures.

The high-voltage insulators within the license renewal scope are the station post insulators associated with the startup transformers, and the high-voltage insulators (post and suspension insulators) associated with the 345-kV switchyard.

The function of high-voltage insulators is to insulate and support an electrical conductor (transmission conductor and switchyard bus). High voltage insulators are passive, long-lived components. Therefore, high voltage insulators meet the criteria of 10 CFR 54.4(a)(3) to recover from station blackout and are subject to an AMR.

Table 2.5.2 lists the component types that require aging management review and their intended functions.

Table 2.5-1
Electrical Commodity Intended Function Definitions

Intended Function	Determination
Electrical Continuity	To provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals.
Insulate (Electrical)	To insulate and support an electrical conductor.

Table 2.5-2
Electrical Commodities Subject to Aging Management

Passive Electrical Commodities	Intended Function
Cable Connection (Metallic Parts)	Electrical Continuity
Insulation Material for Electrical Cables and Connections	Insulate (Electrical)
Switchyard Bus and Connections, Transmission Conductors, and Transmission Connectors	Electrical Continuity
Fuse holders (not part of active equipment): insulation material	Insulate (Electrical)
Fuse holders (not part of active equipment): metallic clamps	Electrical Continuity
High-Voltage Insulators (e.g., porcelain switchyard insulators, transmission line insulators)	Insulate (Electrical)

3.0 AGING MANAGEMENT REVIEW RESULTS

This section provides the results of the Aging Management Review (AMR) for those structures and components identified in Section 2.0 as being subject to AMR. Descriptions of the service environments that were used in the AMRs to determine aging effects requiring management are included in Table 3.0-1, PNPP Service Environments for Mechanical and Structural Aging Management Reviews. The environments used in the aging management reviews are listed in the AMR Environment column. The second column identifies one or more of the NUREG-1801 [Reference 1.3-8] environments that were used when comparing the PNPP AMR results to the NUREG-1801 results. Material and component type equivalences to NUREG-1801 are provided in site supporting documents. The electrical environments in Table 3.0-2, PNPP Service Environments for Electrical Aging Management Reviews, are consistent with the environments in Table IX.D, NUREG-1801. Most of the AMR results information in Section 3 is presented in the following two tables:

- **Table 3.x.1** – where '3' indicates the LRA section number, 'x' indicates the subsection number from NUREG-1800 [Reference 1.3-9] chapter 3, and '1' indicates that this is the first table type in Section 3. For example, in the Reactor Vessel, Internals, and Reactor Coolant System subsection, this table would be number 3.1.1, in the Engineered Safety Features subsection, this table would be 3.2.1, and so on. For ease of discussion, this table will, hereafter, be referred to in this Section as "Table 1."

- **Table 3.x.2-y** – where '3' indicates the LRA section number, 'x' indicates the subsection number from NUREG-1800 chapter 3, and '2' indicates that this is the second table type in Section 3; and 'y' indicates the table number for a specific system. For example, for the Nuclear Boiler, within the Reactor Vessel, Internals, and Reactor Coolant System subsection, this table would be 3.1.2-2 and for the Reactor Coolant Pressure Boundary, it would be Table 3.1.2-3. For the Reactor Core Isolation Cooling System, within the Engineered Safety Features (ESF) subsection, this table would be 3.2.2-7. For the next system within the ESF subsection, it would be Table 3.2.2-8. For ease of discussion, this table will, hereafter, be referred to in this section as "Table 2."

TABLE DESCRIPTION

NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," contains the generic evaluation of existing plant programs. It documents the technical basis for determining where existing programs are adequate without modification, and where existing programs should be augmented for the period of extended operation (PEO). The evaluation results documented in NUREG-1801 indicate that many of the existing programs are adequate to manage the aging effects for structures or components, within the scope of license renewal, without change. NUREG-1801 also contains recommendations on specific areas for which existing programs should be augmented for license renewal. To take full advantage of NUREG-1801, a comparison between the PNPP AMR results and the tables of NUREG-1801 has been performed. The results of that comparison are provided in the following two tables.

Table 1

The purpose of Table 1 is to provide a summary comparison of how the facility aligns with the corresponding tables of NUREG-1800. The table is essentially the same as Tables 3.1.1 through 3.6.1 provided in NUREG-1800, except that the "ID" and "Type" columns have been replaced by an "Item Number" column, and the "Rev2 Item" and "Rev1 Item" columns have been replaced by a "Discussion" column. The "Item Number" column provides the reviewer with a means to cross-reference from Table 2 to Table 1. The "Discussion" column is used to provide clarifying or amplifying information. The following are examples of information that might be contained within this column:

- "Further Evaluation Recommended" information or reference to where that information is located;
- The name of a plant-specific aging management program (AMP) being used, if applicable;
- Exceptions to the NUREG-1800 assumptions, if applicable;
- A discussion of how the line is consistent with the corresponding line item in NUREG-1800, when that may not be intuitively obvious;
- A discussion of how the item is different than the corresponding line item in NUREG- 1800 when it may appear to be consistent (e.g., when there is exception taken to an aging management program that is listed in NUREG-1800), if applicable.

The format of Table 1 provides the reviewer with a means of aligning a specific Table 1 row with the corresponding NUREG-1800 table row, thereby allowing for the ease of checking consistency.

Table 2

Table 2s provide the detailed results of the aging management reviews for those components identified in LRA Section 2 as being subject to aging management review. There will be a Table 2 for each of the systems within a Chapter 3 Section grouping. For example, for PNPP, the Engineered Safety Features System Group contains tables specific to systems such as Residual Heat Removal system, Containment Spray system, Low Pressure Core Spray system, High Pressure Core Spray system, Reactor Core Isolation Cooling system, and Suppression Pool system. Table 2 consists of the following ten columns:

- Row
- Component Type
- Intended Function

- Material
- Environment
- Aging Effect Requiring Management
- Aging Management Program(s)
- NUREG-1801 Item
- Table 1 Item
- Notes

Row – The first column provides a sequential Reference Number for each row within each table.

Component Type – The second column identifies all component types from Section 2 of the LRA that are subject to aging management review. They are listed in alphabetical order.

Intended Function – The third column identifies the license renewal intended functions for the listed component types. Definitions of intended functions are contained in Table 2.3-1 (mechanical), Table 2.4-1 (structural), and Table 2.5-1 (electrical).

Material – The fourth column lists the materials of construction for the component type.

Environment – The fifth column lists the environments to which the component types are exposed. Service environments are indicated, and a list of these environments is provided in Table 3.0-1, PNPP Service Environments for Mechanical and Structural Aging Management Reviews and Table 3.0-2, PNPP Service Environments for Electrical Aging Management Reviews.

Aging Effect Requiring Management – As part of the aging management review process, the aging effects that are required to be managed to maintain the intended function of the component type are identified for the material and environment combination based on operating experience. These aging effects requiring management are listed in the sixth column.

Aging Management Programs (AMPs) – The aging management program(s) used to manage the aging effects requiring management is listed in the seventh column of Table 2. Aging management programs are described in Appendix B.

NUREG-1801 Item – Each combination of component type, material, environment, aging effect requiring management, and aging management program that is listed in Table 2, is compared to NUREG-1801, with consideration given to the standard notes, to identify consistency with the corresponding NUREG-1801 item. Consistency is documented by noting the appropriate NUREG-1801 item number in the eighth column of Table 2. If there is no corresponding item number in NUREG-1801, this field in column eight contains "N/A." Thus, a reviewer can readily identify the correlation between the plant-specific tables and the NUREG-1801 tables.

Table 1 Item – Each combination of component, material, environment, aging effect requiring management, and aging management program that has an identified NUREG-1801 item number must also have a Table 3.x.1 line item Reference number. The corresponding line item from Table 1 is listed in the ninth column of Table 2. If there is no corresponding item in NUREG-1801, this field in column nine contains "N/A." The Table 1 Item allows correlation of the information from the two tables.

Notes – The notes provided in each Table 2 describe how the information in the table aligns with the information in NUREG-1801. Each Table 2 contains standard lettered notes and, if applicable, plant-specific numbered notes. The standard lettered notes (e.g., A, B, C) provide standard information regarding comparison of the PNPP aging management review results with the NUREG-1801 Aging Management Table line item identified in the eighth column. In addition to the standard lettered notes, numbered plant-specific notes provide additional clarifying information when appropriate.

TABLE USAGE

Table 1

The reviewer evaluates each row in Table 1 by moving from left to right across the table. Since the Component, Aging Effect, Aging Management Programs and Further Evaluation Recommended information is taken directly from NUREG-1800, no further analysis of those columns is required. The information intended to help the reviewer the most in this table is contained within the Discussion column. Here the reviewer will be given plant-specific information necessary to determine, in summary, how the PNPP evaluations and programs align with NUREG-1800. This may be in the form of descriptive information within the Discussion column or the reviewer may be referred to other locations within the LRA for further information.

Table 2

Table 2 contains the Aging Management Review information for the plant, regardless whether it aligns with NUREG-1801. For a given row within the table, the reviewer can see the intended function, material, environment, aging effect requiring management and aging management program combination for a specific component type within a system. In addition, if there is a correlation between the combination in Table 2 and a combination in NUREG-1801, this alignment will be identified by a referenced item number in column eight, NUREG-1801 Item. The reviewer can refer to the item number in NUREG-1801, if desired, to verify the correlation. If the column contains an "N/A," no corresponding combination in NUREG-1801 was found. As the reviewer continues across the table from left to right within a given row, the next column is labeled Table 1 Item. If there is a Reference number in this column, the reviewer can use that reference number to locate the corresponding row in Table 1. The discussion in Table 1 amplifies the level of the consistency for this alignment with the NUREG-1801 item and with PNPP components, materials, aging effects, and aging management program. Table 2 provides the reviewer with a means to navigate from the components subject to

Aging Management Review (AMR) in LRA Section 2 all the way through the evaluation of the programs that will be used to manage the effects of aging of those components. A listing of the acronyms used in this section is provided in the LRA Preface.

Cumulative Fatigue Damage and TLAAs in Table 2

A fatigue analysis is considered to be a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3 when it is within the current licensing basis and is based upon transient cycle assumptions associated with 40 years of plant operation. This includes explicit ASME Section III, Class 1 analyses for piping and components and implicit ASME Section III, Class 2 and 3 and ANSI B31.1 analyses for piping. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1).

Table 1 and Table 2 include an entry in the Aging Management Program column indicating "TLAA" for each line item that has a component for which a fatigue TLAA (explicit or implicit) has been identified. See LRA Section 4 for details regarding the PNPP fatigue design bases, fatigue TLAAs identified, and TLAA evaluations for the period of extended operation.

Table 3.0-1
PNPP Service Environments for
Mechanical and Structural Aging Management Reviews

AMR Environment	NUREG 1801 Environment(s) used for AMR comparison [1,2]	Definition
Air - dry	Air - dry	Air that has been treated to reduce its dew point well below the system operating temperature. Within piping systems, unless otherwise specified, this environment may be either internal or external.
Air – indoor, uncontrolled	Air; Air – indoor controlled; Air – indoor, uncontrolled; Air – indoor uncontrolled >35°C (>95°F); Air with Reactor Coolant Leakage; Moist air, System temperature up to 288°C (550°F)	Indoor air with temperatures higher than the dew point. Condensation can occur but only rarely, equipment surfaces are normally dry. If the ambient temperature is maintained <95°F, any resultant thermal aging of organic materials can be considered as insignificant over the 60-yr period of extended operation. For high temperature systems, this environment includes the potential for elevated temperatures that supports cumulative fatigue damage. This name is also used to describe the internal environment of undried compressed air.
Air - outdoor	Air – outdoor; Moist air	The outdoor environment consists of moist, atmospheric air at temperatures and humidity, and exposure to weather, including precipitation and wind. PNPP is not in a coastal area near a body of saltwater but is near roads that are treated with salt during winter months. The component is exposed to air and local weather conditions. Outdoor air does not include the potential to pool water; outdoor environments with the potential for pooled water are called Raw water, Condensation, or Soil (for tank bottoms).
Air with reactor coolant leakage	Air; Air with reactor coolant leakage; System temperature up to 288°C (550°F); Air with steam or water leakage	Air and reactor coolant leakage is on high temperature systems and is applicable only to closure bolting located near the Reactor Pressure Vessel.

Table 3.0-1 (cont.),

PNPP Service Environments for

Mechanical and Structural Aging Management Reviews

AMR Environment	NUREG 1801 Environment(s) used for AMR comparison [1,2]	Definition
Closed-cycle cooling water	Closed-cycle cooling water	Treated water subject to the closed cycle cooling water chemistry program. Closed-cycle cooling water describes the environment in treated closed-cooling and heating systems.
Closed cycle cooling water >60˚C (>140˚F)	Closed-cycle cooling water; Closed-cycle cooling water >60˚C (>140˚F)	Treated water subject to the closed-cycle cooling water chemistry program. Closed-cycle cooling water >60˚C (>140˚F) allows the possibility of stainless steel SCC and may describe the environment in treated closed-cooling or heating systems.
Concrete	Concrete	The external environment of components embedded in concrete.
Condensation	Condensation	Condensation on the surfaces of systems with temperatures below the dew point, or in the associated drains. Condensation may be internal or external but is not used for environments when temperatures exceed 140˚F. Condensation includes the potential for concentration of contaminants. Condensation is also used to describe the dry air environment within the Instrument Air system, to permit alignment with the NUREG-1801 rows that recommend the use of the Compressed Air Monitoring program to preclude moisture.
Diesel exhaust	Diesel exhaust	Gases, fluids, and particulates present in diesel engine exhaust.
Fuel oil	Fuel oil	Diesel oil, No. 2 oil, or other liquid hydrocarbons used to fuel diesel engines. Fuel oil used for combustion engines may include water contamination. The fuel oil environment does not exceed the threshold temperature for cracking of stainless steel (140˚F).
Gas	Gas	Environments of inert or non-reactive gases. Oxygen is not considered to be present in this environment. Gas is used to describe Freon, CO_2 and Halon environments. Reactive replacement gases for Freon and Halon are not included in this environment.

Table 3.0-1 (cont.), PNPP Service Environments for Mechanical and Structural Aging Management Reviews

AMR Environment	NUREG 1801 Environment(s) used for AMR comparison [1,2]	Definition
Lubricating oil	Lubricating oil	Lubricating oils are low-to-medium viscosity hydrocarbons, with the possibility of containing contaminants and/or moisture, used for bearing, gear, and engine lubrication. This name is also used to describe non-water based hydraulic fluid (Fyrquel), and the 3M NOVEC™ 7100 refrigerant used in the Offgas system.
Raw water	Ground water; Raw water; Water, flowing or standing	Raw, untreated, river, lake, ground or potable water. Raw water does not exceed the threshold temperature for SCC of stainless steels (140°F). If raw water is considered aggressive to structural components, additional aging management methods may be required.
Reactor coolant	Reactor coolant	Treated water in the reactor coolant system and connected systems at or near full operating temperature. Reactor coolant includes the steam phase. The Reactor coolant environment name is used for the reactor vessel and internals components. The environment for connected piping and systems is referred to as one of the Treated water environments.
Reactor coolant >250°C (>482°F) and neutron flux	Reactor coolant; Reactor coolant >250°C (>482°F); Reactor coolant >250°C (>482°F) and neutron flux; Treated water	Water in the reactor coolant system above the thermal embrittlement threshold for CASS, and above the fluence threshold for neutron embrittlement. The Reactor coolant environment name is used for the reactor vessel and internals components. The environment for connected piping and systems is referred to as one of the Treated water environments.
Reactor coolant and neutron flux	Reactor coolant; Reactor coolant and neutron flux	Reactor core environment that will result in a neutron fluence exceeding the threshold for management at the end of the license renewal term. The Reactor coolant environment name is used for the reactor vessel and internals components. The environment for connected piping and systems is referred to as one of the Treated water environments.

Table 3.0-1 (cont.),
PNPP Service Environments for
Mechanical and Structural Aging Management Reviews

AMR Environment	NUREG 1801 Environment(s) used for AMR comparison [1,2]	Definition
Sodium pentaborate solution	Sodium pentaborate solution, Treated water	Treated water that contains a mixture of borax and boric acid.
Soil	Soil; Water - flowing under foundation; Water – flowing or standing	External environment for components exposed to soil (including the air/soil interface) or buried in the soil, including groundwater in the soil. This name is also used to describe the environment for exterior surface of outdoor tank bottoms that are mounted on a concrete pad. Buried components are not expected to exceed the threshold temperature for SCC (140°F).
Treated water	Treated water; Reactor coolant; Steam	Treated water is demineralized water. Treated water could be deaerated and include corrosion inhibitors, biocides, other additives such as glycol, or some combination of these treatments. Treated water does not contain significant concentrations of boric acid at PNPP. This environment may represent liquid or steam/vapor.
Treated water >250°C (>482°F)	Steam, Reactor coolant, Treated water, Reactor Coolant >250°C (>482°F)	Treated water above the thermal embrittlement threshold for cast austenitic stainless steel of 250°C (482°F). This environment may represent liquid or steam/vapor.
Treated water >60°C (>140°F)	Treated water; Treated water >60°C (>140°F)	Treated water above the 60°C (140°F) stress corrosion cracking threshold for stainless steel. This environment may represent liquid or steam/vapor.
Waste water	Waste water	Radioactive, potentially radioactive, or non-radioactive water that is collected from equipment and floor drains. Waste waters may contain contaminants, including oil, as well as originally-treated water that is not monitored by a chemistry program.

Table 3.0-1 Notes

1. For metallic bolting and closure bolting, any AMR environment is considered equivalent to any GALL environment for evaluation of GALL consistency for Loss of preload due to thermal effects, gasket creep.
2. Air with borated water leakage is not used as it is germane to PWRs and not BWRs.

Table 3.0-2

PNPP Service Environments for

Electrical Aging Management Reviews

AMR Environment	**NUREG-1801 Environment(s) used for AMR comparison**	**Definition**[1]
Adverse Localized Environment	Adverse Localized Environment	An adverse localized environment is an environment limited to the immediate vicinity of a component that is hostile to the component material, thereby leading to potential aging effects. As used in GALL, the conductor insulation used for electrical cables in instrumentation circuits can be subjected to an adverse localized environment. As represented by a specific GALL AMR Item, an adverse localized environment can be due to any of the following: (1) exposure to significant moisture (LP-35), (2) heat, radiation, or moisture (L-01 or LP-34), or (3) heat, radiation, moisture, or voltage (L-05).
Air - indoor, controlled	Air - indoor, controlled	This environment is one to which the specified internal or external surface of the component or structure is exposed; a humidity-controlled (i.e., air conditioned) environment. For electrical purposes, control must be sufficient to eliminate the cited aging effects of contamination and oxidation without affecting the resistance.
Air - indoor, uncontrolled	Air - indoor, uncontrolled	Uncontrolled indoor air is associated with systems with temperatures higher than the dew point (i.e., condensation can occur, but only rarely; equipment surfaces are normally dry).
Air - indoor uncontrolled >35˚C (>95˚F) (Internal/External) [2]	Air -indoor uncontrolled >35˚C (>95˚F) (Internal/External)	Uncontrolled indoor air >35˚C (>95˚F) is above a thermal stress threshold for elastomers (i.e., <95˚F). It is an environment to which the internal or external surface of the component or structure can be exposed. If the ambient temperature is maintained <95˚F, any resultant thermal aging of organic materials can be considered as insignificant over the 60-yr period of extended operation. (Ref 3) [4] However, elastomers can be subjected to aging effects from other factors, such as exposure to ozone, oxidation, and radiation.

Table 3.0-2 (cont.),

PNPP Service Environments for

Electrical Aging Management Reviews

AMR Environment	**NUREG-1801 Environment(s) used for AMR comparison**	**Definition** [1]
Air – outdoor[3]	Air – outdoor	The outdoor environment consists of moist, possibly salt-laden atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation and wind. The component is exposed to air and local weather conditions, including salt water spray (if present). A component is considered susceptible to a wetted environment when it is submerged, has the potential to collect water, or is subject to external condensation.

Table 3.0-2 Notes

1. The environments used in Section 3.6 are consistent with the definitions in NUREG-1801, Section IX.D, which are reproduced here.
2. This environment is not used in Table 3.6.2 – Electrical Commodities - Summary of Aging Management Evaluation. It is listed as a mutually exclusive alternative to Air – Indoor, uncontrolled. For higher temperatures see Adverse localized environments caused by heat. As noted in NUREG-1801, Section IX.D, "when applied to the elastomers used in electrical cable insulation, it should be noted that most cable insulation is manufactured as either 75°C (167°F) or 90°C (194°F) rated material."
3. PNPP is not in a coastal area near a body of saltwater but is near roads that are treated with salt during winter months. Outdoor air does not include the potential to pool water.
4. The source reference material is cited as (Ref 3) referring to Reference 3 in Section IX.G of NUREG-1801, Revision 2.

3.1 AGING MANAGEMENT OF REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

3.1.1 INTRODUCTION

This Section provides the results of the aging management reviews for components identified in Section 2.3.1, Reactor Vessel, Internals and Reactor Coolant System, as being subject to aging management review. The systems, or portions of systems, which are addressed in this Section are described in the Sections indicated below.

- Fuel (Section 2.3.1.1)
- Nuclear Boiler (Section 2.3.1.2)
- Reactor Coolant Pressure Boundary (Section 2.3.1.3)
- Reactor Recirculation (Section 2.3.1.4)
- Reactor Vessel (Section 2.3.1.5)
- Reactor Vessel Internals (Section 2.3.1.6)

3.1.2 RESULTS

The following tables summarize the results of the aging management review for Reactor Vessel, Internals, and Reactor Coolant System:

- Table 3.1.2-1 Fuel
- Table 3.1.2-2 Nuclear Boiler
- Table 3.1.2-3 Reactor Coolant Pressure Boundary
- Table 3.1.2-4 Reactor Recirculation
- Table 3.1.2-5 Reactor Vessel
- Table 3.1.2-6 Reactor Vessel Internals

Note that Table 3.1.2-1 Fuel System did not have any components subject to aging management review and the corresponding AMR results table contains no components.

3.1.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the Reactor Vessel, Internals, and Reactor Coolant System components subject to aging management review. Aging Management Programs are described in Appendix B. Further details are provided in the system tables.

3.1.2.1.1 Fuel

Fuel components are constructed of the following materials:

- N/A

Environments

Fuel components are exposed to the following environments:

- N/A

Aging Effects Requiring Management

The following aging effects associated with the Fuel components require management:

- N/A

Aging Management Programs

The following aging management programs manage the effects of aging on Fuel components:

- N/A

3.1.2.1.2 <u>Nuclear Boiler</u>

Materials

Nuclear Boiler components are constructed of the following materials:

- aluminum
- nickel alloy
- stainless steel
- steel

Environments

Nuclear Boiler components are exposed to the following environments:

- air – dry
- air – indoor, uncontrolled

- treated water
- treated water >60˚C (>140˚F)

Aging Effects Requiring Management

The following aging effects associated with the Nuclear Boiler components require management:

- cracking
- cumulative fatigue damage
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Nuclear Boiler components:

- Bolting Integrity (B.2.7)
- Compressed Air Monitoring (B.2.16)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.1.2.1.3 Reactor Coolant Pressure Boundary

Materials

Reactor Coolant Pressure Boundary components are constructed of the following materials:

- CASS
- High strength steel
- Stainless steel
- Steel
- Steel with stainless steel cladding

Environments

Reactor Coolant Pressure Boundary components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air with reactor coolant leakage
- Closed-cycle cooling water
- Sodium pentaborate solution
- Treated water
- Treated water >250˚C (>482˚F)
- Treated water >60˚C (>140˚F)

Aging Effects Requiring Management

The following aging effects associated with the Reactor Coolant Pressure Boundary components require management:

- Cracking
- Cumulative fatigue damage
- Loss of fracture toughness
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Reactor Coolant Pressure Boundary components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.3)
- Bolting Integrity (B.2.7)
- BWR Stress Corrosion Cracking (B.2.12)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- One-Time Inspection (B.2.35)
- One-Time Inspection of ASME Code Class 1 Small Bore-Piping (B.2.36)
- TLAA
- Water Chemistry (B.2.44)

3.1.2.1.4 Reactor Recirculation

Materials

Reactor Recirculation components are constructed of the following materials:

- Aluminum
- Copper Alloy >15% Zn
- Glass
- Gray cast iron
- Stainless steel
- Steel

Environments

Reactor Recirculation components are exposed to the following environments:

- Air – indoor, uncontrolled
- Gas
- Lubricating oil
- Treated water
- Treated water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the Reactor Recirculation components require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Reactor Recirculation components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.1.2.1.5 Reactor Vessel

Materials

Reactor Vessel components are constructed of the following materials:

- High strength steel
- Nickel-alloy
- Stainless steel
- Steel
- Steel with stainless steel cladding

Environments

Reactor Vessel components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air with reactor coolant leakage
- Reactor coolant
- Reactor coolant and neutron flux

Aging Effects Requiring Management

The following aging effects associated with the Reactor Vessel components require management:

- Cracking
- Cumulative fatigue damage
- Loss of fracture toughness
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Reactor Vessel components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.3)
- Bolting Integrity (B.2.7)
- BWR Control Rod Drive Return Line Nozzle (B.2.9)
- BWR Feedwater Nozzle (B.2.10)
- BWR Penetrations (B.2.11)
- BWR Stress Corrosion Cracking (B.2.12)
- BWR Vessel ID Attachment Welds (B.2.13)
- One-Time Inspection (B.2.35)
- Reactor Head Closure Stud Bolting (B.2.39)
- Reactor Vessel Surveillance (B.2.40)
- TLAA
- Water Chemistry (B.2.44)

3.1.2.1.6 Reactor Vessel Internals

Materials

Reactor Vessel Internals components are constructed of the following materials:

- CASS
- Nickel-alloy
- Stainless steel
- X-750

Environments

Reactor Vessel Internals components are exposed to the following environments:

- Air – indoor, uncontrolled
- Reactor coolant
- Reactor coolant >250°C (>482°F) and neutron flux
- Reactor coolant and neutron flux

Aging Effects Requiring Management

The following aging effects associated with the Reactor Vessel Internals components require management:

- Cracking

- Cumulative fatigue damage
- Loss of fracture toughness
- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on Reactor Vessel Internals components:

- BWR Vessel Internals (B.2.14)
- TLAA
- Water Chemistry (B.2.44)

3.1.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 (Reference 1.3-9) indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.1.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the PNPP approach to these areas requiring further evaluation. Programs are described in Appendix B.

Note - Italicized text at the beginning of each Further Evaluation subsection is taken directly from NUREG-1800 as supplemented by LR-ISG-2011-04 and LR-ISG-2011-05.

3.1.2.2.1 Cumulative Fatigue Damage

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-LR.

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of metal fatigue as a TLAA for the Reactor Vessel, Reactor Vessel Internals, Reactor Coolant Pressure Boundary, Nuclear Boiler, and Reactor Recirculation system are discussed in Section 4.3.1 (Class 1) and 4.3.2 (non-Class1). In addition, non-Class 1 components from the Auxiliary Systems (Post Accident Sampling) and Steam and Power Conversion Systems (Main and Reheat Steam, Main, Reheat, Extraction, and Miscellaneous Drains, and Auxiliary Steam and Drains) are discussed in Section 4.3.2 either specifically or as part of the global evaluation. Likewise, metal fatigue of the Auxiliary Steam and Drains, Main and Reheat Steam, Main, Reheat, Extraction and Misc Drains, and Post Accident Sampling systems is also addressed in Section 4.3. See Section 4.3 for a complete evaluation of metal fatigue.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

1. *Loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. The existing program relies on control of water chemistry to mitigate corrosion and Inservice Inspection (ISI) to detect loss of material. The extent and schedule of the existing steam generator inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, according to NRC Information Notice (IN) 90-04, the program may not be sufficient to detect pitting and crevice corrosion, if general and pitting corrosion of the shell is known to exist. The GALL Report recommends augmented inspection to manage this aging effect. Furthermore, the GALL Report clarifies that this issue is limited to Westinghouse Model 44 and 51 Steam Generators, where a high-stress region exists at the shell to transition cone weld. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).*

This paragraph in NUREG-1800 pertains to pressurized water reactor (PWR) steam generators and is therefore not applicable to PNPP.

2. *Loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam. The existing program relies on control of secondary water chemistry to mitigate corrosion. However, some applicants have replaced only the bottom part of their recirculating steam generators, generating a cut in the middle of the transition cone, and, consequently, a new transition cone closure weld. The GALL Report recommends volumetric examinations performed in accordance with the requirements of ASME Code Section XI for upper shell-to and lower shell-to transition cones with gross structural discontinuities for managing loss of material due to general, pitting, and crevice corrosion in the welds for Westinghouse Model 44 and 51 Steam Generators, where a high-stress region exists at the shell to transition cone weld.*

   The new continuous circumferential weld, resulting from cutting the transition cone as discussed above, is a different situation from the SG transition cone welds containing geometric discontinuities. Control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. The new transition area weld is a field-weld as opposed to having been made in a controlled manufacturing facility, and the surface conditions of the transition weld may result in flow conditions more conducive to initiation of general, pitting, and crevice corrosion than those of the upper and lower transition cone welds. Crediting of the ISI program for the new SG transition cone weld may not be an effective basis for managing loss of material in this weld, as the ISI criteria would only perform a VT-2 visual leakage examination of the weld as part of the system leakage test performed pursuant to ASME Section XI requirements. In addition, ASME Section XI does not require licensees to *remove insulation when performing visual examination on non-borated treated water systems. Therefore, the effectiveness of the chemistry control program should be verified to ensure that loss of material due to general, pitting and crevice corrosion is not occurring.*

For the new continuous circumferential weld, the GALL Report recommends further evaluation to verify the effectiveness of the chemistry control program. A one-time inspection at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly, such that the component's intended function will be maintained during the period of extended operation. Furthermore, the GALL Report clarifies that this issue is limited to replacement recirculating steam generators with a new transition cone closure weld.

This paragraph in NUREG-1800 pertains to PWR steam generator shell assemblies and is therefore not applicable to PNPP.

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

1. *Neutron irradiation embrittlement is a TLAA to be evaluated for the period of extended operation for all ferritic materials that have a neutron fluence greater than 1017 n/cm2 (E >1 MeV) at the end of the license renewal term. Certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). This TLAA is addressed separately in Section 4.2, "Reactor Vessel Neutron Embrittlement Analysis," of this SRP-LR.*

Neutron irradiation embrittlement is a TLAA evaluated for the period of extended operation in accordance with 10 CFR 54.21(c). The evaluation of loss of fracture toughness for the reactor vessel beltline shell and welds is discussed in Section 4.2.

2. *Loss of fracture toughness due to neutron irradiation embrittlement could occur in BWR and PWR reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. The reactor vessel surveillance program is plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further staff evaluation is required for license renewal. Specific recommendations for an acceptable AMP are provided in Chapter XI, Section M31 of the GALL Report.*

The Reactor Vessel Surveillance Program manages reduction in fracture toughness due to neutron embrittlement of reactor vessel beltline materials. PNPP is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP). This program monitors changes in the fracture toughness properties of ferritic materials in the reactor pressure vessel (RPV) beltline region. As described in Appendix B, the Reactor Vessel Surveillance Program is consistent with the program described in NUREG-1801, (Reference 1.3-8) Section XI.M31, Reactor Vessel Surveillance.

3. Ductility – Reduction in Fracture Toughness is a plant-specific TLAA for Babcock and Wilcox (B&W) reactor internals to be evaluated for the period of extended operation in accordance with the staff's safety evaluation concerning "Demonstration of the Management of Aging Effects for the Reactor Vessel Internals," Babcock and Wilcox Owners Group report number BAW-2248, which is included in BAW-2248A, March 2000. Plant-specific TLAAs are addressed in Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," of this SRP-LR.

This paragraph in NUREG-1800 pertains to a plant-specific TLAA for Babcock and Wilcox reactor internals and is therefore not applicable to PNPP.

3.1.2.2.4 Cracking due to Stress Corrosion Cracking (SCC) and Intergranular Stress Corrosion Cracking (IGSCC)

1. Cracking due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC) could occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

This paragraph in NUREG-1800 addresses cracking due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC) in stainless steel and nickel-alloy BWR top head enclosure vessel flange leak detection lines. The top head enclosure vessel flange leak detection line at PNPP is carbon steel piping, not stainless steel, and is therefore not susceptible to SCC or IGSCC.

2. Cracking due to SCC and IGSCC could occur in stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program relies on control of reactor water chemistry to mitigate SCC and on ASME Section XI ISI to detect cracking. However, the existing program should be augmented to detect cracking due to SCC and IGSCC. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water and eddy current testing of tubes to ensure that the component's intended function will be maintained during the period of extended operation. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

This paragraph in NUREG-1800 pertains to BWR isolation condenser components. PNPP does not have an isolation condenser, so this paragraph was not used.

3.1.2.2.5 Crack Growth due to Cyclic Loading

Crack growth due to cyclic loading could occur in reactor vessel shell forgings clad with stainless steel using a high-heat-input welding process. Growth of intergranular separations (underclad cracks) in the heat-affected zone under austenitic stainless steel cladding is a TLAA to be evaluated for the period of extended operation for all the SA-508-Cl-2 forgings where the cladding was deposited with a high heat input welding process.

This paragraph in NUREG-1800 applies to PWRs only and is therefore not applicable to PNPP.

3.1.2.2.6 Cracking due to Stress Corrosion Cracking

1. *Cracking due to SCC could occur in the PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).*

2. *Cracking due to SCC could occur in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping, piping components, and piping elements exposed to reactor coolant. The existing program relies on control of water chemistry to mitigate SCC; however, SCC could occur for CASS components that do not meet the NUREG- 0313 guidelines with regard to ferrite and carbon content. The GALL Report recommends further evaluation of a plant-specific program for these components to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).*

Both paragraphs in NUREG-1800 apply to PWRs only and are therefore not applicable to PNPP.

3.1.2.2.7 Cracking due to Cyclic Loading

Cracking due to cyclic loading could occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program relies on ASME Section XI ISI. However, the existing program should be augmented to detect cracking due to cyclic loading. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water and eddy current testing of tubes to ensure that the component's intended function will be maintained during the period of extended operation. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

This paragraph in NUREG-1800 pertains to BWR isolation condenser components. As PNPP does not have an isolation condenser, this paragraph was not used.

3.1.2.2.8 Loss of Material due to Erosion

Loss of material due to erosion could occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

This paragraph in NUREG-1800 applies to PWRs only only and is therefore not applicable to PNPP.

3.1.2.2.9 Cracking due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking

Cracking due to SCC and irradiation-assisted stress corrosion cracking (IASCC) could occur in inaccessible locations for stainless steel and nickel-alloy Primary and Expansion PWR reactor vessel internal components. If aging effects are identified in accessible locations, the GALL Report recommends further evaluation of the aging effects in inaccessible locations on a plant specific basis to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

Removed per LR-ISG-2011-04.

3.1.2.2.10 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement, Change in Dimension due to Void Swelling, Loss of Preload due to Stress Relaxation, or Loss of Material due to Wear

Loss of fracture toughness due to neutron irradiation embrittlement, change in dimension due to void swelling, loss of preload due to stress relaxation, or loss of material due to wear could occur in inaccessible locations for stainless steel and nickel-alloy Primary and Expansion PWR reactor vessel internal components. If aging effects are identified in accessible locations, the GALL Report recommends further evaluation of the aging effects in inaccessible locations on a plant-specific basis to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

Removed per LR-ISG-2011-04.

3.1.2.2.11 Cracking due to Primary Water Stress Corrosion Cracking (PWSCC).

1. *Foreign operating experience in steam generators with a similar design to that of Westinghouse Model 51 has identified extensive cracking due to primary water stress corrosion cracking (PWSCC) in steam generator (SG) divider plate assemblies fabricated of Alloy 600 and/or the associated Alloy 600 weld materials, even with proper primary water chemistry (EPRI TR-1014982). Cracks have been detected in the stub runner, adjacent to the tubesheet/stub runner weld and with depths of almost a third of the divider*

plate thickness. Therefore, the water chemistry program may not be effective in managing the aging effect of cracking due to PWSCC in SG divider plate assemblies. This is of particular concern for steam generators where the tube-tubesheet welds are considered structural welds and/or where the divider plate assembly contributes to the mechanical integrity of the tubesheet. Although these SG divider plate cracks may not have a significant safety impact in and of themselves, these cracks could impact adjacent items, such as the tubesheet and the channel head, if they propagate to the boundary with these items. For the tubesheet, PWSCC cracks in the divider plate could propagate to the tubesheet cladding with possible consequences to the integrity of the tube/tubesheet welds. For the channel head, the PWSCC cracks in the divider plate could propagate to the SG triple point and potentially affect the pressure boundary of the SG channel head. The existing program relies on control of reactor water chemistry to mitigate cracking due to PWSCC. The GALL Report recommends that a plant-specific AMP be evaluated, along with the primary water chemistry program, because the existing primary water chemistry program may not be capable of mitigating cracking due to PWSCC. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

2. *Cracking due to PWSCC could occur in steam generator nickel alloy tube-to-tubesheet welds exposed to reactor coolant. Unless the NRC has approved a redefinition of the pressure boundary in which the tube-to-tubesheet weld is no longer included, the effectiveness of the primary water chemistry program should be verified to ensure cracking is not occurring:*

   - *For plants with Alloy 600 steam generator tubes that have not been thermally treated and for which an alternate repair criteria such as C*, F* or W* has been permanently approved, the weld is no longer part of the pressure boundary and no plant specific aging management program is required;*

   - *For plants with Alloy 600 steam generator tubes that have not been thermally treated and for which there is no permanently approved alternate repair criteria such as C*, F* or W*, a plant-specific AMP is required;*

   - *For plants with Alloy 600TT steam generator tubes and for which an alternate repair criteria such as H* has been permanently approved, the weld is no longer part of the pressure boundary and no plant specific aging management program is required;*

   - *For plants with Alloy 600TT steam generator tubes and for which there is no alternate repair criteria such as H* permanently approved, a plant-specific AMP is required;*

- *For plants with Alloy 690TT steam generator tubes with Alloy 690 tubesheet cladding, the water chemistry is sufficient, and no further action or plant-specific aging management program is required;*
- *For plants with Alloy 690TT steam generator tubes and with Alloy 600 tubesheet cladding, either a plant-specific program or a rationale for why such a program is not needed is required.*

The existing program relies on control of reactor water chemistry to mitigate cracking due to PWSCC. The GALL Report recommends that a plant-specific AMP be evaluated, along with the primary water chemistry program, because the existing primary water chemistry program may not be capable of mitigating cracking due to PWSCC. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

These paragraphs in NUREG-1800 apply to PWRs only and is therefore not applicable to PNPP.

3.1.2.2.12 Cracking due to Fatigue

EPRI 1016596, Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-Rev. 0) identifies cracking due to fatigue as an aging effect that can occur for the lower flange weld in the core support barrel assembly, fuel alignment plate in the upper internals assembly, and core support plate lower support structure in PWR internals designed by Combustion Engineering. The GALL Report recommends that inspection for cracking in this component be performed if acceptable fatigue life cannot be demonstrated by TLAA through the period of extended operation as defined in 10 CFR 54.3.

Removed per LR-ISG-2011-04.

3.1.2.2.13 Cracking due to Stress Corrosion Cracking and Fatigue

Cracking due to stress corrosion cracking and fatigue could occur in nickel alloy control rod guide tube assemblies, guide tube support pins exposed to reactor coolant, and neutron flux. The GALL Report, AMR Item IV.B2.RP-355, recommends further evaluation of a plant-specific AMP to ensure this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

Removed per LR-ISG-2011-04.

3.1.2.2.14 Loss of Material due to Wear

Loss of material due to wear could occur in nickel alloy control rod guide tube assemblies, guide tube support pins and in Zircaloy-4 incore instrumentation lower thimble tubes exposed to reactor coolant, and neutron flux. The GALL Report, AMR Items IV.B2.RP-356 and IV.B3.RP- 357, recommends further evaluation of a plant-

specific AMP to ensure this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

Removed per LR-ISG-2011-04.

3.1.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2 of this SRP-LR).

See Appendix B, Section B.1.3, for discussion of PNPP quality assurance procedures and administrative controls for aging management programs.

3.1.2.2.16 Ongoing Review of Operating Experience (Per LR-ISG-2011-05)

Ongoing review of operating experience is addressed in Appendix A, Section A.1 and Appendix B, Section B.1.4.

3.1.2.3 Time-Limited Aging Analyses

The time-limited aging analyses identified associated with the Reactor Vessel, Internals, and Reactor Coolant System components are addressed in Section 4. Table 4.1-2 provides TLAA results and identifies whether the TLAA remains valid for the PEO, will be managed during the PEO, and the LRA sections that address them.

3.1.3 Conclusion

The Reactor Vessel, Internals, and Reactor Coolant System piping fittings and components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage aging effects for the Reactor Vessel, Internals, and Reactor Coolant System components are identified in the summaries in Section 3.1.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Reactor Vessel, Internals and Reactor Coolant System components will be adequately managed so that there is reasonable assurance that the intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-1	High strength, low-alloy steel top head closure stud assembly exposed to air with potential for reactor coolant leakage	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA (See subsection 3.1.2.2.1)	Consistent with NUREG-1801. Cumulative fatigue damage is evaluated as a TLAA. See further evaluation section 3.1.2.2.1.
3.1.1-2	PWR only				
3.1.1-3	Stainless steel or nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA (See subsection 3.1.2.2.1)	Consistent with NUREG-1801. Cumulative fatigue damage is evaluated as a TLAA. See further evaluation section 3.1.2.2.1.
3.1.1-4	Steel pressure vessel support skirt and attachment welds	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA (See subsection 3.1.2.2.1)	Consistent with NUREG-1801. Cumulative fatigue damage is evaluated as a TLAA. See further evaluation section 3.1.2.2.1.
3.1.1-5	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-6	Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel-alloy reactor coolant pressure boundary components: piping, piping components, and piping elements exposed to reactor coolant	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed. (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA (See subsection 3.1.2.2.1)	Consistent with NUREG-1801. Cumulative fatigue damage is evaluated as a TLAA. See further evaluation section 3.1.2.2.1.
3.1.1-7	Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed. (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA (See subsection 3.1.2.2.1)	Consistent with NUREG-1801. Cumulative fatigue damage is evaluated as a TLAA. See further evaluation section 3.1.2.2.1.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-8	PWR only				
3.1.1-9	PWR only				
3.1.1-10	PWR only				
3.1.1-11	Steel or stainless steel pump and valve closure bolting exposed to high temperatures and thermal cycles	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation; check ASME Code limits for allowable cycles (less than 7000 cycles) of thermal stress range. (SRP Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA (See subsection 3.1.2.2.1)	Consistent with NUREG-1801. Fatigue is evaluated as a TLAA in LRA Section 4.3. See further evaluation section 3.1.2.2.1. Closure bolting in the Main and Reheat Steam, and the Main, Reheat, Extraction, and Miscellaneous Drains and the Auxiliary Steam systems are also aligned to this row. Additionally, hot (heat traced) stainless steel piping and valves in the Post-Accident Sampling system that are exposed to air are aligned to this row.
3.1.1-12	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-13	Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds exposed to reactor coolant and neutron flux	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA is to be evaluated in accordance with Appendix G of 10 CFR Part 50 and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations	Yes, TLAA (See subsection 3.1.2.2.3.1)	Consistent with NUREG-1801. Loss of fracture toughness is evaluated as a TLAA. See further evaluation section 3.1.2.2.3.1.
3.1.1-14	Steel (with or without cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles	Loss of fracture toughness due to neutron irradiation embrittlement	Chapter XI.M31, “Reactor Vessel Surveillance”	Yes, plant specific or integrated surveillance program (See subsection 3.1.2.2.3.2)	Consistent with NUREG-1801. Loss of fracture toughness is evaluated as a TLAA. See further evaluation section 3.1.2.2.3.2.
3.1.1-15	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-16	Stainless steel and nickel alloy top head enclosure vessel flange leak detection line	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line	Yes, plant-specific (See subsection 3.1.2.2.4.1)	Not applicable. There are no stainless steel or nickel alloy top head enclosure vessel flange leak detection piping components in the Reactor Vessel, Internals, and Reactor Coolant systems. The top head enclosure vessel flange leak detection line is carbon steel piping that is not susceptible to stress corrosion cracking (SCC) or intergranular stress corrosion cracking (IGSCC). See further evaluation section 3.1.2.2.4.1.
3.1.1-17	Stainless steel isolation condenser components exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry" for BWR water, and a plant-specific verification program	Yes, detection of aging effects is to be evaluated (See subsection 3.1.2.2.4.2)	Not applicable. PNPP does not have an isolation condenser. See further evaluation section 3.1.2.2.4.2.
3.1.1-18	PWR only				
3.1.1-19	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-20	PWR only				
3.1.1-21	Steel and stainless steel isolation condenser components exposed to reactor coolant	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components The ISI program is to be augmented by a plant-specific verification program	Yes, detection of aging effects is to be evaluated (See subsection 3.1.2.2.7)	Not applicable. PNPP does not have an isolation condenser. See further evaluation subsection 3.1.2.2.7.
3.1.1-22	PWR only				
3.1.1-23	PWR only				
3.1.1-24	PWR only				
3.1.1-25	PWR only				
3.1.1-26	PWR only				
3.1.1-27	PWR only				
3.1.1-28	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-29	Nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” and Chapter XI.M2, “Water Chemistry,” and for BWRs with a crevice in the access hole covers, augmented inspection using UT or other acceptable techniques	No	Consistent with NUREG-1801 but is being managed by a different set of programs (BWR Vessel Internals and Water Chemistry) and with some program exceptions. The core shroud and access hole covers are stainless steel and nickel alloy. Cracking of this component is also addressed in item 3.1.1-103. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-30	Stainless steel or nickel alloy penetration: drain line exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801 for different components and with some program exceptions. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry programs will manage cracking of steel with stainless steel cladding reactor vessel shell and bottom head components. PNPP does not have a stainless steel or nickel alloy drain line exposed to reactor coolant. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.1.1-31	Steel and stainless steel isolation condenser components exposed to reactor coolant	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry"	No	Not applicable. PNPP does not have an isolation condenser.
3.1.1-32	PWR only				
3.1.1-33	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-34	PWR only				
3.1.1-35	PWR only				
3.1.1-36	PWR only				
3.1.1-37	PWR only				
3.1.1-38	Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250 deg-C (>482 deg-F)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components. For pump casings and valve bodies, screening for susceptibility to thermal aging is not necessary.	No	Consistent with NUREG-1801. Loss of fracture toughness of pump casings and valve bodies is managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-39	Steel, stainless steel, or steel with stainless steel cladding Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal, mechanical, and vibratory loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, Chapter XI.M2, "Water Chemistry," and XI.M35, "One-Time Inspection of ASME Code Class 1 Small-bore Piping"	No	Consistent with NUREG-1801 with some program exceptions. Cracking of Class 1 stainless steel valves and piping components < NPS 4 in the Reactor Coolant Pressure Boundary system is managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, Water Chemistry, and One-Time Inspection of ASME Code Class 1 Small Bore-Piping programs. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.1.1-40	PWR only				
3.1.1-40x	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-41	Nickel alloy core shroud and core plate access hole cover (mechanical covers) exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components, and Chapter XI.M2, “Water Chemistry”	No	Not applicable. The core shroud support and access hole covers are stainless steel and contain nickel alloy. Cracking of these components is addressed in items 3.1.1-29 and 3.1.1-103.
3.1.1-42	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-43	Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801 for material, environment, and aging effect but with different programs credited and some program exceptions. Loss of material for stainless steel, and nickel alloy (including X-750) reactor vessel internals components is managed by the BWR Vessel Internals and Water Chemistry programs. This difference from the GALL recommendation is consistent with the purpose of the BWR Vessel Internals program. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.1.1-44	PWR only				
3.1.1-45	PWR only				
3.1.1-46	PWR only				
3.1.1-47	PWR only				
3.1.1-48	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-49	PWR only				
3.1.1-50	Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant >250 deg-C (>482 deg-F)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No	Not applicable. PNPP does not have cast austenitic stainless steel Class 1 piping, piping components, and piping elements or control rod drive pressure housings other than the pump casings and valve bodies addressed in item 3.1.1-38 that are exposed to reactor coolant >250 deg-C (>482 deg-F) subject to Loss of fracture toughness. The control rod drive housings are stainless steel and nickel alloy.
3.1.1-51	PWR only				
3.1.1-52	PWR only				
3.1.1-53	PWR only				
3.1.1-54	PWR only				
3.1.1-55	PWR only				
3.1.1-56	PWR only				
3.1.1-57	There is no Item Number 3.1.1-57 in NUREG-1800 Rev. 2 or subsequent ISGs.				
3.1.1-58	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-59	PWR only				
3.1.1-60	Steel piping, piping components, and piping elements exposed to reactor coolant	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, “Flow-Accelerated Corrosion”	No	Consistent with NUREG-1801. The Flow- Accelerated Corrosion program will manage wall thinning (loss of material) due to flow accelerated corrosion of steel components exposed to reactor coolant (called "treated water" in the AMRs) in the Nuclear Boiler and Reactor Coolant Pressure Boundary systems.
3.1.1-61	PWR only				
3.1.1-62	PWR only				
3.1.1-63	Steel or stainless steel closure bolting exposed to air with reactor coolant leakage	Loss of material due to general (steel only), pitting, and crevice corrosion or wear	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity program will manage loss of material for steel and high strength steel bolting exposed to air with reactor coolant leakage (other than the head closure stud assemblies that are addressed in Item 3.1.1-91).
3.1.1-64	PWR only				
3.1.1-65	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-66	PWR only				
3.1.1-67	Steel or stainless steel closure bolting exposed to air – indoor with potential for reactor coolant leakage	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity program will manage loss of preload for steel and high strength steel bolting exposed to air - indoor uncontrolled, and air with reactor coolant leakage in the Reactor Coolant Pressure Boundary, Reactor Vessel, Nuclear Boiler and Reactor Recirculation systems.
3.1.1-68	PWR only				
3.1.1-69	PWR only				
3.1.1-70	PWR only				
3.1.1-71	PWR only				
3.1.1-72	PWR only				
3.1.1-73	PWR only				
3.1.1-74	PWR only				
3.1.1-75	PWR only				
3.1.1-76	PWR only				
3.1.1-77	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-78	PWR only				
3.1.1-79	Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 for most components and with some program exceptions. The Water Chemistry program will manage loss of material of stainless steel, nickel alloy, and steel with stainless steel cladding components exposed to reactor coolant (called "Treated water" in the AMRs) in the Reactor Coolant Pressure Boundary, Nuclear Boiler and Reactor Recirculation systems. The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. Loss of material due to erosion of the main steam line flow restrictor venturis is evaluated as a TLAA in LRA Section 4.6.2. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-80	PWR only				
3.1.1-81	PWR only				
3.1.1-82	PWR only				
3.1.1-83	PWR only				
3.1.1-84	Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage loss of material of steel top head components, nozzles and other Reactor Vessel components and welds exposed to reactor coolant. The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-85	Stainless steel, nickel- alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage loss of material of stainless steel, nickel alloy, and steel with stainless steel cladding Reactor Vessel components exposed to reactor coolant. The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.1.1-86	PWR only				
3.1.1-87	PWR only				
3.1.1-88	PWR only				
3.1.1-89	PWR only				
3.1.1-90	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-91	High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage	Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (BWR)	Chapter XI.M3, “Reactor Head Closure Stud Bolting”	No	Consistent with NUREG-1801 with some program exceptions. The Reactor Head Closure Stud Bolting program will manage loss of material and cracking of high-strength steel Reactor Vessel closure head stud assemblies exposed to air with reactor coolant leakage. See Appendix B Section B.2.39 for Rx Head Closure Stud Bolting program exceptions to NUREG-1801.
3.1.1-92	PWR only				
3.1.1-93	PWR only				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-94	Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M4, “BWR Vessel ID Attachment Welds,” and Chapter XI.M2, “Water Chemistry”	No	Consistent with NUREG-1801 with some program exceptions. The BWR Vessel ID Attachment Welds and Water Chemistry programs will manage cracking of stainless steel Reactor Vessel shell attachment welds exposed to reactor coolant. PNPP does not have nickel alloy vessel shell attachment welds exposed to reactor coolant in the Reactor Vessel, Internals, and Reactor Coolant systems. Nickel alloy nozzle and safe end welds are addressed by item 3.1.1-97. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801. See Appendix B Section B.2.13 for BWR Vessel ID Attachment Welds program exceptions to NUREG-1801.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-95	Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant	Cracking due to cyclic loading	Chapter XI.M5, "BWR Feedwater Nozzle"	No	Consistent with NUREG-1801 with some program exceptions. The BWR Feedwater Nozzle program will manage cracking of the Reactor Vessel feedwater nozzle exposed to reactor coolant. See Appendix B Section B.2.10 for BWR Feedwater Nozzle program exceptions to NUREG-1801.
3.1.1-96	Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant	Cracking due to cyclic loading	Chapter XI.M6, "BWR Control Rod Drive Return Line Nozzle"	No	Consistent with NUREG-1801. The BWR Control Rod Drive Return Line Nozzle program will manage cracking of the (capped) Reactor Vessel control rod drive return nozzle exposed to reactor coolant.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-97	Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801 with some program exceptions. The BWR Stress Corrosion Cracking and Water Chemistry programs will manage cracking of stainless steel, nickel alloy and steel with stainless steel cladding piping, piping components, and piping elements greater than or equal to NPS 4, nozzles, safe ends and associated welds in the Reactor Coolant Pressure Boundary and Reactor Vessel systems. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-98	Stainless steel or nickel alloy penetrations: instrumentation and standby liquid control exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	Chapter XI.M8, "BWR Penetrations," and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801 with the following clarification and with some program exceptions. The BWR Penetrations and Water Chemistry programs will manage cracking of stainless steel and nickel alloy control rod drive housings and incore housings that penetrate the Reactor Vessel and are exposed to reactor coolant. The Standby Liquid Control System does not connect to the Reactor Vessel directly, it connects to the High Pressure Core Spray supply line. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-99	Cast austenitic stainless steel; PH martensitic stainless steel; martensitic stainless steel; X-750 alloy reactor internal components exposed to reactor coolant and neutron flux	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Chapter XI.M9, "BWR Vessel Internals"	No	Consistent with NUREG-1801. The BWR Vessel Internals program will manage loss of fracture toughness of cast austenitic stainless steel and X-750 Reactor Vessel Internals components exposed to reactor coolant and neutron flux. PNPP does not have PH martensitic stainless steel or martensitic stainless steel Reactor Vessel Internal components.
3.1.1-100	Stainless steel reactor vessel internals components (jet pump wedge surface) exposed to reactor coolant	Loss of material due to wear	Chapter XI.M9, "BWR Vessel Internals"	No	Consistent with NUREG-1801. Loss of material for the jet pump restrainer bracket surface is aligned to this row to address wear. The Water Chemistry program is also credited for management of loss of material due to pitting and crevice corrosion, consistent with the discussion in 3.1.1-43.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-101	Stainless steel steam dryers exposed to reactor coolant	Cracking due to flow- induced vibration	Chapter XI.M9, "BWR Vessel Internals" for steam dryer	No	Consistent with NUREG-1801. The BWR Vessel Internals program will manage cracking of the stainless steel steam dryer.
3.1.1-102	Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M9, “BWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry”	No	Consistent with NUREG-1801 with some program exceptions. The BWR Vessel Internals and Water Chemistry programs will manage cracking of stainless steel fuel supports and control rod drive tube components exposed to reactor coolant. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-103	Stainless steel and nickel alloy reactor internal components exposed to reactor coolant and neutron flux	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801 for most components and with some program exceptions. The BWR Vessel Internals and Water Chemistry programs will manage cracking of stainless steel and nickel alloy reactor internals components exposed to reactor coolant and neutron flux that are not addressed by item 3.1.1-102. For the Incore dry tube assemblies, cracking is managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry programs. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-104	X-750 alloy reactor vessel internal components exposed to reactor coolant and neutron flux	Cracking due to intergranular stress corrosion cracking	Chapter XI.M9, “BWR Vessel Internals” for core plate, and Chapter XI.M2, “Water Chemistry”	No	Consistent with NUREG-1801 with some program exceptions. The BWR Vessel Internals and Water Chemistry programs will manage cracking of X-750 vessel internals components exposed to reactor coolant and neutron flux. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.1.1-105	Steel piping, piping components and piping element exposed to concrete	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Not applicable. PNPP does not have steel piping, piping components or piping elements exposed to concrete in the Reactor Vessel, Internals or Reactor Coolant systems.

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-106	Nickel alloy piping, piping components and piping element exposed to air – indoor, uncontrolled, or air with borated water leakage	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.1.1-107	Stainless steel piping, piping components and piping element exposed to gas, concrete, air with borated water leakage, air – indoors, uncontrolled	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. In addition to the Reactor Vessel, Internals, and Reactor Coolant systems; stainless steel commodities in concrete in the Bulk Civil Commodities, Containment Structure, and Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures have been aligned with this item.
3.1.1-108	There is no Item Number 3.1.1-108 in NUREG-1800 Rev. 2 or subsequent ISGs.				
3.1.1-109	There is no Item Number 3.1.1-109 in NUREG-1800 Rev. 2 or subsequent ISGs.				

Table 3.1.1: Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System Components in Chapter IV of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-110 (LR-ISG-2012-01)	Any material, piping, piping components, and piping elements exposed to reactor coolant	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Not applicable. Steel piping, piping components and piping elements in the Reactor Vessel, Internals and Reactor Coolant systems that are susceptible to wall thinning due to flow-accelerated corrosion are managed by the Flow-Accelerated Corrosion program as described in item 3.1.1-60. There is no other piping, piping component, or piping element materials exposed to reactor coolant that have been identified as susceptible to wall thinning due to erosion in the Reactor Vessel, Internals or Reactor Coolant systems.

Table 3.1.2-1
Reactor Vessel, Internals and Reactor Coolant Systems – Fuel
Summary of Aging Management Evaluation

Table 3.1.2-1 – Fuel System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
No Components Subject to Aging Management Review									

Table 3.1.2-2
Reactor Vessel, Internals and Reactor Coolant Systems – Nuclear Boiler
Summary of Aging Management Evaluation

Table 3.1.2-2 - Nuclear Boiler System									
Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
1	Accumulator	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 105
2	Accumulator	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
3	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	A
4	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	A
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A
6	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	A
7	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	A
8	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A

Table 3.1.2-2 - Nuclear Boiler System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Filter housing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
10	Flexible hose	Pressure boundary	Nickel alloy	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 111
11	Flexible hose	Pressure boundary	Nickel alloy	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-03	3.1.1-106	A
12	Flexible hose	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 105
13	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
14	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
15	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
16	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
17	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A

Table 3.1.2-2 - Nuclear Boiler System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
18	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
19	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
20	Orifice	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
21	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
22	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
23	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
24	Piping	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
25	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A

Table 3.1.2-2 - Nuclear Boiler System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
26	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
27	Piping	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 105
28	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
29	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
30	Piping	Pressure boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
31	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
32	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
33	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A

Table 3.1.2-2 - Nuclear Boiler System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
34	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
35	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
36	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
37	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
38	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
39	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
40	Piping	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 105
41	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A

Table 3.1.2-2 - Nuclear Boiler System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
42	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
43	Piping	Structural integrity	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
44	Piping	Structural integrity	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
45	Piping	Structural integrity	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
46	SRV Discharge Quencher	Pressure boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
47	SRV Discharge Quencher	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
48	Strainer body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
49	Strainer body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A

Table 3.1.2-2 - Nuclear Boiler System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
50	Strainer body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
51	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
52	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
53	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
54	Valve body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
55	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
56	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
57	Valve body	Pressure boundary	Aluminum	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-134	3.3.1-113	E, 105
58	Valve body	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A

Table 3.1.2-2 - Nuclear Boiler System									
Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
59	Valve body	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 105
60	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
61	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
62	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
63	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
64	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
65	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
66	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A

Table 3.1.2-2 - Nuclear Boiler System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
67	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
68	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
69	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
70	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.1.2-3
Reactor Vessel, Internals and Reactor Coolant Systems – Reactor Coolant Pressure Boundary
Summary of Aging Management Evaluation

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
1	Bolting	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Cracking	Bolting Integrity	V.E.E-03	3.2.1-12	A
2	Bolting	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A
3	Bolting	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	A
4	Bolting	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	A
5	Bolting	Pressure boundary	Steel	Air with reactor coolant leakage (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A
6	Bolting	Pressure boundary	Steel	Air with reactor coolant leakage (Ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	A
7	Bolting	Pressure boundary	Steel	Air with reactor coolant leakage (Ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	A
8	Condensing chamber	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
9	Condensing chamber	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	ASME Section XI Inservice Inspection,	IV.C1.RP-230	3.1.1-39	B

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
						Subsections IWB, IWC, and IWD, Water Chemistry, and One-Time Inspection of ASME Code Class 1 Small Bore-Piping			
10	Condensing chamber	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
11	Condensing chamber	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
12	Control rod drive mechanism	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
13	Control rod drive mechanism	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.C1.R-20	3.1.1-97	B
14	Control rod drive mechanism	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
15	Control rod drive mechanism	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
16	Flow restrictor	Pressure boundary, Flow restriction	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
17	Flow restrictor	Pressure boundary, Flow restriction	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
18	Flow restrictor	Pressure boundary, Flow restriction	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
19	Flow restrictor	Pressure boundary, Flow restriction	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
20	Flow restrictor	Pressure boundary, Flow restriction	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
21	Flow restrictor	Pressure boundary, Flow restriction	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
22	Flow restrictor	Pressure boundary, Flow restriction	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
23	Flow restrictor	Pressure boundary, Flow restriction	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
24	Flow restrictor	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of	V.E.E-44	3.2.1-40	A

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
	(Main steam - Body)					Mechanical Components			
25	Flow restrictor (Main steam - Body)	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
26	Flow restrictor (Main steam - Body)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
27	Flow restrictor (Main steam - Body)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
28	Flow restrictor (Main steam - Venturi)	Flow restriction	CASS	Treated water >250°C (>482°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.B2.SP-98	3.4.1-11	B, 101
29	Flow restrictor (Main steam - Venturi)	Flow restriction	CASS	Treated water >250°C (>482°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
30	Flow restrictor (Main steam - Venturi)	Flow restriction	CASS	Treated water >250°C (>482°F) (Int)	Loss of material	TLAA	IV.C1.RP-158	3.1.1-79	E, 104
31	Flow restrictor (Main steam - Venturi)	Flow restriction	CASS	Treated water >250°C (>482°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
32	Heat exchanger (Recirc pump seal cooler)	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	V.D2.EP-93	3.2.1-31	A
33	Heat exchanger (Recirc pump seal cooler)	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Ext)	Cracking	Water Chemistry and One-Time Inspection	VII.E3.AP-112	3.3.1-20	B
34	Heat exchanger (Recirc pump seal cooler)	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
35	Piping (Class 1) < NPS 4	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
36	Piping (Class 1) < NPS 4	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
37	Piping (Class 1) < NPS 4	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, Water Chemistry, and One-Time Inspection of ASME Code Class 1 Small Bore-Piping	IV.C1.RP-230	3.1.1-39	B

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
38	Piping (Class 1) < NPS 4	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
39	Piping (Class 1) < NPS 4	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
40	Piping (Class 1) < NPS 4	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
41	Piping (Class 1) < NPS 4	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
42	Piping (Class 1) < NPS 4	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
43	Piping (Class 1) < NPS 4	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
44	Piping (Class 1) >= NPS 4	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
45	Piping (Class 1) >= NPS 4	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.C1.R-20	3.1.1-97	B
46	Piping (Class 1) >= NPS 4	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
47	Piping (Class 1) >= NPS 4	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
48	Piping (Class 1) >= NPS 4	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
49	Piping (Class 1) >= NPS 4	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
50	Piping (Class 1) >= NPS 4	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
51	Piping (Class 1) >= NPS 4	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
52	Pump casing	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
53	Pump casing	Pressure boundary	CASS	Treated water >250°C (>482°F) (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.C1.R-20	3.1.1-97	B
54	Pump casing	Pressure boundary	CASS	Treated water >250°C (>482°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
55	Pump casing	Pressure boundary	CASS	Treated water >250°C (>482°F) (Int)	Loss of fracture toughness	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1.R-08	3.1.1-38	A

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
56	Pump casing	Pressure boundary	CASS	Treated water >250°C (>482°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
57	Pump casing	Pressure boundary	Steel with stainless steel cladding	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
58	Pump casing	Pressure boundary	Steel with stainless steel cladding	Treated water >60°C (>140°F) (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.C1.R-20	3.1.1-97	B
59	Pump casing	Pressure boundary	Steel with stainless steel cladding	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
60	Pump casing	Pressure boundary	Steel with stainless steel cladding	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
61	Valve body	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
62	Valve body	Pressure boundary	CASS	Treated water >250°C (>482°F) (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.C1.R-20	3.1.1-97	B
63	Valve body	Pressure boundary	CASS	Treated water >250°C (>482°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
64	Valve body	Pressure boundary	CASS	Treated water >250°C (>482°F) (Int)	Loss of fracture toughness	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1.R-08	3.1.1-38	A
65	Valve body	Pressure boundary	CASS	Treated water >250°C (>482°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
66	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
67	Valve body	Pressure boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B, 110
68	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
69	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, Water Chemistry, and One-Time Inspection of ASME Code Class 1 Small Bore-Piping	IV.C1.RP-230	3.1.1-39	B
70	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A

Table 3.1.2-3 - Reactor Coolant Pressure Boundary System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
71	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
72	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.E.E-44	3.2.1-40	A
73	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
74	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
75	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.1.2-4
Reactor Vessel, Internals and Reactor Coolant Systems – Reactor Recirculation
Summary of Aging Management Evaluation

Table 3.1.2-4 - Reactor Recirculation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Accumulator	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
2	Accumulator	Leakage boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
3	Accumulator	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A, 103
4	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	A
5	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	A
6	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	A
7	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	A
8	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.1.2-4 - Reactor Recirculation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Filter housing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A, 103
10	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
11	Flexible hose	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
12	Heat exchanger (Oil cooler header)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
13	Heat exchanger (Oil cooler header)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-131	3.3.1-98	A, 103
14	Heat exchanger (Oil cooler tube)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
15	Heat exchanger (Oil cooler tube)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-131	3.3.1-98	A, 103
16	Orifice	Pressure boundary, Flow restriction	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A

Table 3.1.2-4 - Reactor Recirculation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
17	Orifice	Pressure Boundary, Flow restriction	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
18	Orifice	Pressure boundary, Flow restriction	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
19	Orifice	Pressure boundary, Flow restriction	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
20	Orifice	Pressure boundary, Flow restriction	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
21	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
22	Piping	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	A, 103
23	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
24	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B

Table 3.1.2-4 - Reactor Recirculation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
25	Piping	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
26	Piping	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
27	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
28	Piping	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A, 103
29	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
30	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
31	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
32	Piping	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
33	Piping	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A

Table 3.1.2-4 - Reactor Recirculation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
34	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
35	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
36	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
37	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
38	Pump casing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A, 103
39	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
40	Sight glass	Leakage boundary	Glass	Lubricating oil (Int)	None	None	VII.J.AP-15	3.3.1-117	A, 103
41	Sight glass (Body)	Leakage boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A

Table 3.1.2-4 - Reactor Recirculation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
42	Sight glass (Body)	Leakage boundary	Aluminum	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-162	3.3.1-99	A, 103
43	Tank	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
44	Tank	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	C, 103
45	Valve body	Leakage boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A
46	Valve body	Leakage boundary	Aluminum	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-162	3.3.1-99	A, 103
47	Valve body	Leakage boundary	Copper Alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
48	Valve body	Leakage boundary	Copper Alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A, 103
49	Valve body	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.1.2-4 - Reactor Recirculation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
50	Valve body	Leakage boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A, 103
51	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
52	Valve body	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	A, 103
53	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
54	Valve body	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A, 103
55	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
56	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
57	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
58	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B

Table 3.1.2-4 - Reactor Recirculation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
59	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	IV.C1.R-220	3.1.1-6	A
60	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.C1.RP-158	3.1.1-79	B
61	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
62	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A

Table 3.1.2-5
Reactor Vessel, Internals and Reactor Coolant Systems – Reactor Vessel
Summary of Aging Management Evaluation

Table 3.1.2-5 - Reactor Vessel									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting (Vessel nozzle flanges)	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Cracking	Bolting Integrity	V.E.E-03	3.2.1-12	A, 107
2	Bolting (Vessel nozzle flanges)	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A, 107
3	Bolting (Vessel nozzle flanges)	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	A, 107
4	Bolting (Vessel nozzle flanges)	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	A, 107
5	Control rod drive housing	Pressure boundary	Nickel alloy	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-03	3.1.1-106	C
6	Control rod drive housing	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Cracking	BWR Penetrations and Water Chemistry	IV.A1.RP-369	3.1.1-98	B, 108
7	Control rod drive housing	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A

Table 3.1.2-5 - Reactor Vessel

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
8	Control rod drive housing	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
9	Control rod drive housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	C
10	Control rod drive housing	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cracking	BWR Penetrations and Water Chemistry	IV.A1.RP-369	3.1.1-98	D, 108
11	Control rod drive housing	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
12	Control rod drive housing	Pressure boundary	Stainless steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
13	Core spray bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel ID Attachment Welds and Water Chemistry	IV.A1.R-64	3.1.1-94	B
14	Core spray bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
15	Core spray bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
16	Dryer holddown bracket and weld	Structural support	Steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A

Table 3.1.2-5 - Reactor Vessel

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
17	Dryer holddown bracket and weld	Structural support	Steel	Reactor coolant (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	D
18	Dryer support bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel ID Attachment Welds and Water Chemistry	IV.A1.R-64	3.1.1-94	B
19	Dryer support bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
20	Dryer support bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
21	Feedwater sparger bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel ID Attachment Welds and Water Chemistry	IV.A1.R-64	3.1.1-94	B
22	Feedwater sparger bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
23	Feedwater sparger bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
24	Guide rod bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel ID Attachment Welds and	IV.A1.R-64	3.1.1-94	B

Table 3.1.2-5 - Reactor Vessel									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
						Water Chemistry			
25	Guide rod bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
26	Guide rod bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
27	Head closure studs, nuts, washers	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Cracking	Reactor Head Closure Stud Bolting	IV.A1.RP-51	3.1.1-91	B, 106
28	Head closure studs, nuts, washers	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Cumulative fatigue damage	TLAA	IV.A1.RP-201	3.1.1-1	A, 106
29	Head closure studs, nuts, washers	Pressure boundary	High strength steel	Air with reactor coolant leakage (Ext)	Loss of material	Reactor Head Closure Stud Bolting	IV.A1.RP-165	3.1.1-91	B
30	Incore housing	Pressure boundary	Nickel alloy	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-03	3.1.1-106	C
31	Incore housing	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Cracking	BWR Penetrations and Water Chemistry	IV.A1.RP-369	3.1.1-98	B
32	Incore housing	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A

Table 3.1.2-5 - Reactor Vessel									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
33	Incore housing	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
34	Incore housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	C
35	Incore housing	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cracking	BWR Penetrations and Water Chemistry	IV.A1.RP-369	3.1.1-98	B
36	Incore housing	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
37	Incore housing	Pressure boundary	Stainless steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
38	Jet pump riser brace and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel ID Attachment Welds and Water Chemistry	IV.A1.R-64	3.1.1-94	B
39	Jet pump riser brace and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
40	Nozzle and safe end welds	Pressure boundary	Nickel alloy	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-03	3.1.1-106	A

Table 3.1.2-5 - Reactor Vessel									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
41	Nozzle and safe end welds	Pressure boundary	Nickel alloy	Reactor coolant and neutron flux (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.A1.R-68	3.1.1-97	B
42	Nozzle and safe end welds	Pressure boundary	Nickel alloy	Reactor coolant and neutron flux (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
43	Nozzle and safe end welds	Pressure boundary	Nickel alloy	Reactor coolant and neutron flux (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
44	Nozzle and safe end welds	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	A
45	Nozzle and safe end welds	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.A1.R-68	3.1.1-97	B
46	Nozzle and safe end welds	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
47	Nozzle and safe end welds	Pressure boundary	Stainless steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
48	Nozzle and safe end welds	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102

Table 3.1.2-5 - Reactor Vessel									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
49	Nozzle and safe end welds	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
50	Nozzle and safe end welds	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	D
51	Nozzle safe ends	Pressure boundary	Nickel alloy	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-03	3.1.1-106	C
52	Nozzle safe ends	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.A1.R-68	3.1.1-97	B
53	Nozzle safe ends	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
54	Nozzle safe ends	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
55	Nozzle safe ends	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	C
56	Nozzle safe ends	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.A1.R-68	3.1.1-97	B
57	Nozzle safe ends	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A

Table 3.1.2-5 - Reactor Vessel

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
58	Nozzle safe ends	Pressure boundary	Stainless steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
59	Nozzle safe ends	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
60	Nozzle safe ends	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
61	Nozzle safe ends	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	B
62	Nozzle thermal sleeves	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.A1.R-68	3.1.1-97	B
63	Nozzle thermal sleeves	Pressure boundary	Stainless steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
64	Nozzle thermal sleeves	Pressure boundary	Stainless steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
65	Specimen bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel ID Attachment Welds and Water Chemistry	IV.A1.R-64	3.1.1-94	B

Table 3.1.2-5 - Reactor Vessel									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
66	Specimen bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
67	Specimen bracket and weld	Structural support	Stainless steel	Reactor coolant (Ext)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
68	Support skirt	Structural support	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.A1.R-70	3.1.1-4	A
69	Support skirt	Structural support	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	V.E.E-44	3.2.1-40	E
70	Vessel bottom head	Pressure boundary	Steel with stainless steel cladding	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
71	Vessel bottom head	Pressure boundary	Steel with stainless steel cladding	Reactor coolant (Int)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry	IV.A1.RP-371	3.1.1-30	D
72	Vessel bottom head	Pressure boundary	Steel with stainless steel cladding	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A

Table 3.1.2-5 - Reactor Vessel

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
73	Vessel bottom head	Pressure boundary	Steel with stainless steel cladding	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
74	Vessel nozzle (Capped control rod drive return)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
75	Vessel nozzle (Capped control rod drive return)	Pressure boundary	Steel	Reactor coolant (Int)	Cracking	BWR Control Rod Drive Return Line Nozzle	IV.A1.R-66	3.1.1-96	A
76	Vessel nozzle (Capped control rod drive return)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
77	Vessel nozzle (Capped control rod drive return)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	D
78	Vessel nozzle (Core D/P)	Pressure boundary	Nickel alloy	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-03	3.1.1-106	C
79	Vessel nozzle (Core D/P)	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.A1.R-68	3.1.1-97	D
80	Vessel nozzle (Core D/P)	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A

Table 3.1.2-5 - Reactor Vessel

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
81	Vessel nozzle (Core D/P)	Pressure boundary	Nickel alloy	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
82	Vessel nozzle (Core spray)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
83	Vessel nozzle (Core spray)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
84	Vessel nozzle (Core spray)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	D
85	Vessel nozzle (Feedwater)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
86	Vessel nozzle (Feedwater)	Pressure boundary	Steel	Reactor coolant (Int)	Cracking	BWR Feedwater Nozzle	IV.A1.R-65	3.1.1-95	B
87	Vessel nozzle (Feedwater)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
88	Vessel nozzle (Feedwater)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	D
89	Vessel nozzle (Low pressure coolant injection/RHR)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102

Table 3.1.2-5 - Reactor Vessel

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
90	Vessel nozzle (Low pressure coolant injection/RHR)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
91	Vessel nozzle (Low pressure coolant injection/RHR)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	D
92	Vessel nozzle (Main steam, Head vent, Drain, Vibration instrumentation)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
93	Vessel nozzle (Main steam, Head vent, Drain, Vibration instrumentation)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
94	Vessel nozzle (Main steam, Head vent, Drain, Vibration instrumentation)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	B
95	Vessel nozzle (Recirc in / out)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
96	Vessel nozzle (Recirc in / out)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
97	Vessel nozzle (Recirc in / out)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and	IV.A1.RP-50	3.1.1-84	D

Table 3.1.2-5 - Reactor Vessel

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
						One-Time Inspection			
98	Vessel nozzle (Seal leak)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
99	Vessel nozzle (Seal leak)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
100	Vessel nozzle (Seal leak)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	D
101	Vessel nozzle (Water level instrumentation)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	IV.E.RP-04	3.1.1-107	C
102	Vessel nozzle (Water level instrumentation)	Pressure boundary	Stainless steel	Reactor coolant and neutron flux (Int)	Cracking	BWR Stress Corrosion Cracking and Water Chemistry	IV.A1.R-68	3.1.1-97	D
103	Vessel nozzle (Water level instrumentation)	Pressure boundary	Stainless steel	Reactor coolant and neutron flux (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
104	Vessel nozzle (Water level instrumentation)	Pressure boundary	Stainless steel	Reactor coolant and neutron flux (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B

Table 3.1.2-5 - Reactor Vessel									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
105	Vessel shell (Beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
106	Vessel shell (Beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Reactor coolant and neutron flux (Int)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry	IV.A1.RP-371	3.1.1-30	D
107	Vessel shell (Beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Reactor coolant and neutron flux (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
108	Vessel shell (Beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Reactor coolant and neutron flux (Int)	Loss of fracture toughness	Reactor Vessel Surveillance	IV.A1.RP-227	3.1.1-14	A
109	Vessel shell (Beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Reactor coolant and neutron flux (Int)	Loss of fracture toughness	TLAA	IV.A1.R-62	3.1.1-13	A
110	Vessel shell (Beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Reactor coolant and neutron flux (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
111	Vessel shell (Closure flange and welds)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102

Table 3.1.2-5 - Reactor Vessel									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
112	Vessel shell (Closure flange and welds)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
113	Vessel shell (Closure flange and welds)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	B
114	Vessel shell (Non-beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
115	Vessel shell (Non-beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Reactor coolant (Int)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry	IV.A1.RP-371	3.1.1-30	D
116	Vessel shell (Non-beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
117	Vessel shell (Non-beltline plates and welds)	Pressure boundary	Steel with stainless steel cladding	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-157	3.1.1-85	B
118	Vessel upper head (Closure flange)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102

Table 3.1.2-5 - Reactor Vessel

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
119	Vessel upper head (Closure flange)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
120	Vessel upper head (Closure flange)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	B
121	Vessel upper head (Dome)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	C, 102
122	Vessel upper head (Dome)	Pressure boundary	Steel	Reactor coolant (Int)	Cumulative fatigue damage	TLAA	IV.A1.R-04	3.1.1-7	A
123	Vessel upper head (Dome)	Pressure boundary	Steel	Reactor coolant (Int)	Loss of material	Water Chemistry and One-Time Inspection	IV.A1.RP-50	3.1.1-84	B

Table 3.1.2-6
Reactor Vessel, Internals and Reactor Coolant Systems – Reactor Vessel Internals
Summary of Aging Management Evaluation

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting (Core support plate, Top guide)	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-93	3.1.1-103	B
2	Bolting (Core support plate, Top guide)	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
3	Bolting (Core support plate, Top guide)	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
4	Control rod guide tube	Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-104	3.1.1-102	B
5	Control rod guide tube	Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
6	Control rod guide tube	Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-220	3.1.1-99	A

Table 3.1.2-6 - Reactor Vessel Internals

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
7	Control rod guide tube	Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
8	Control rod guide tube	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-104	3.1.1-102	B
9	Control rod guide tube	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
10	Control rod guide tube	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
11	Control rod guide tube (Thermal sleeve)	Structural support	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-104	3.1.1-102	B
12	Control rod guide tube (Thermal sleeve)	Structural support	Stainless steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
13	Control rod guide tube (Thermal sleeve)	Structural support	Stainless steel	Reactor coolant (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
14	Core plate assembly	Structural support	Stainless steel	Reactor coolant and	Cracking	BWR Vessel Internals and	IV.B1.R-93	3.1.1-103	B

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
				neutron flux (Ext)		Water Chemistry			
15	Core plate assembly	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
16	Core plate assembly	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
17	Core shroud	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-92	3.1.1-103	B
18	Core shroud	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
19	Core shroud	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
20	Core shroud (access hole cover)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-94	3.1.1-29	E
21	Core shroud (access hole cover)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A

Table 3.1.2-6 - Reactor Vessel Internals

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
22	Core shroud (access hole cover)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	B
23	Core shroud (access hole cover)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-92	3.1.1-103	B
24	Core shroud (access hole cover)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
25	Core shroud (access hole cover)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
26	Core shroud support	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-96	3.1.1-103	B
27	Core shroud support	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
28	Core shroud support	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
29	Core spray lines, spargers and spray nozzles	Flow control	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-99	3.1.1-103	B
30	Core spray lines, spargers and spray nozzles	Flow control	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
31	Core spray lines, spargers and spray nozzles	Flow control	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-220	3.1.1-99	C
32	Core spray lines, spargers and spray nozzles	Flow control	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
33	Core spray lines, spargers and spray nozzles	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-99	3.1.1-103	B
34	Core spray lines, spargers and spray nozzles	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
35	Core spray lines, spargers and spray nozzles	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
36	Dry tube assembly	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
37	Dry tube assembly	Pressure boundary	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-105	3.1.1-103	B
38	Dry tube assembly	Pressure boundary	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
39	Head spray nozzle	Flow control	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-99	3.1.1-103	B
40	Head spray nozzle	Flow control	Stainless steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
41	Head spray nozzle	Flow control	Stainless steel	Reactor coolant (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
42	Incore guide tube	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-105	3.1.1-103	B
43	Incore guide tube	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
44	Incore guide tube	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
45	Incore guide tube stabilizer	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-105	3.1.1-103	B
46	Incore guide tube stabilizer	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
47	Jet pump (Bolting)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
48	Jet pump (Bolting)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
49	Jet pump (Bolting)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
50	Jet pump (Bracket restrainer)	Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B

Table 3.1.2-6 - Reactor Vessel Internals

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
51	Jet pump (Bracket restrainer)	Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
52	Jet pump (Bracket restrainer)	Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-219	3.1.1-99	A
53	Jet pump (Bracket restrainer)	Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
54	Jet pump (Diffuser adaptor)	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
55	Jet pump (Diffuser adaptor)	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
56	Jet pump (Diffuser adaptor)	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-219	3.1.1-99	A

Table 3.1.2-6 - Reactor Vessel Internals

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
57	Jet pump (Diffuser adaptor)	Flow control, Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
58	Jet pump (Diffuser)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
59	Jet pump (Diffuser)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
60	Jet pump (Diffuser)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
61	Jet pump (Diffuser)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
62	Jet pump (Diffuser)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
63	Jet pump (Diffuser)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E

Table 3.1.2-6 - Reactor Vessel Internals

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
64	Jet pump (Hold-down beam)	Structural support	X-750	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.RP-381	3.1.1-104	B
65	Jet pump (Hold-down beam)	Structural support	X-750	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
66	Jet pump (Hold-down beam)	Structural support	X-750	Reactor coolant and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-200	3.1.1-99	A
67	Jet pump (Hold-down beam)	Structural support	X-750	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
68	Jet pump (Mixer assembly)	Flow control, Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
69	Jet pump (Mixer assembly)	Flow control, Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
70	Jet pump (Mixer assembly)	Flow control, Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-219	3.1.1-99	A

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
71	Jet pump (Mixer assembly)	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
72	Jet pump (Mixer assembly)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
73	Jet pump (Mixer assembly)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
74	Jet pump (Mixer assembly)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
75	Jet pump (Mixer assembly)	Flow control, Structural support	X-750	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.RP-381	3.1.1-104	B
76	Jet pump (Mixer assembly)	Flow control, Structural support	X-750	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
77	Jet pump (Mixer assembly)	Flow control, Structural support	X-750	Reactor coolant and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-200	3.1.1-99	A

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
78	Jet pump (Mixer assembly)	Flow control, Structural support	X-750	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
79	Jet pump (Nozzle assembly)	Flow control, Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
80	Jet pump (Nozzle assembly)	Flow control, Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
81	Jet pump (Nozzle assembly)	Flow control, Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-219	3.1.1-99	A
82	Jet pump (Nozzle assembly)	Flow control, Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
83	Jet pump (Riser pipe, elbow, brace)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
84	Jet pump (Riser pipe, elbow, brace)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A

Table 3.1.2-6 - Reactor Vessel Internals

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
85	Jet pump (Riser pipe, elbow, brace)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
86	Jet pump (Thermal sleeve)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
87	Jet pump (Thermal sleeve)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
88	Jet pump (Thermal sleeve)	Flow control, Structural support	Nickel alloy	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
89	Jet pump (Thermal sleeve)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
90	Jet pump (Thermal sleeve)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
91	Jet pump (Thermal sleeve)	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
92	Jet pump (Transition piece)	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
93	Jet pump (Transition piece)	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
94	Jet pump (Transition piece)	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-219	3.1.1-99	A
95	Jet pump (Transition piece)	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
96	Jet pump (Wedge)	Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-100	3.1.1-103	B
97	Jet pump (Wedge)	Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
98	Jet pump (Wedge)	Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-219	3.1.1-99	A
99	Jet pump (Wedge)	Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals	IV.B1.RP-377	3.1.1-100	A, 109
100	Jet pump (Wedge)	Structural support	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
101	Jet pump (Wedge)	Structural support	X-750	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.RP-381	3.1.1-104	B
102	Jet pump (Wedge)	Structural support	X-750	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
103	Jet pump (Wedge)	Structural support	X-750	Reactor coolant and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-200	3.1.1-99	A
104	Jet pump (Wedge)	Structural support	X-750	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
105	Low pressure coolant injection flow deflector	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-97	3.1.1-103	B
106	Low pressure coolant injection flow deflector	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
107	Low pressure coolant injection lines	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-97	3.1.1-103	B
108	Low pressure coolant injection lines	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
109	Low pressure coolant injection lines	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
110	Low pressure coolant injection lines (Castings)	Flow control	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-97	3.1.1-103	B
111	Low pressure coolant injection lines (Castings)	Flow control	CASS	Reactor coolant >250°C (>482°F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
112	Low pressure coolant injection lines (Castings)	Flow control	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-220	3.1.1-99	C
113	Low pressure coolant injection lines (Castings)	Flow control	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
114	Orificed fuel support	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-104	3.1.1-102	B
115	Orificed fuel support	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
116	Orificed fuel support	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of fracture toughness	BWR Vessel Internals	IV.B1.RP-220	3.1.1-99	A
117	Orificed fuel support	Flow control, Structural support	CASS	Reactor coolant >250˚C (>482˚F) and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
118	Peripheral fuel support	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-104	3.1.1-102	B
119	Peripheral fuel support	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
120	Peripheral fuel support	Flow control, Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
121	Peripheral fuel support orifice	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-104	3.1.1-102	B
122	Peripheral fuel support orifice	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
123	Peripheral fuel support orifice	Flow control	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
124	Shroud head bolt assembly	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-92	3.1.1-103	B
125	Shroud head bolt assembly	Structural support	Stainless steel	Reactor coolant and	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A

Table 3.1.2-6 - Reactor Vessel Internals									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
				neutron flux (Ext)					
126	Shroud head bolt assembly	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
127	Steam dryer	Structural support	Stainless steel	Reactor coolant (Ext)	Cracking	BWR Vessel Internals	IV.B1.RP-155	3.1.1-101	A
128	Steam dryer	Structural support	Stainless steel	Reactor coolant (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
129	Steam dryer	Structural support	Stainless steel	Reactor coolant (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E
130	Top guide assembly	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cracking	BWR Vessel Internals and Water Chemistry	IV.B1.R-98	3.1.1-103	B
131	Top guide assembly	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Cumulative fatigue damage	TLAA	IV.B1.R-53	3.1.1-3	A
132	Top guide assembly	Structural support	Stainless steel	Reactor coolant and neutron flux (Ext)	Loss of material	BWR Vessel Internals and Water Chemistry	IV.B1.RP-26	3.1.1-43	E

Notes for Table 3.1.2-1 through Table 3.1.2-6

Standard Notes

A. Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material, and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination are evaluated in NUREG-1801.

Plant-Specific Notes

101 Main steam line venturi material is A-351 grade CF8 (low molybdenum), with ferrite <20%. Based on the criteria set forth in the May 19, 2000, NRC (Grimes) letter, this material is not susceptible to thermal embrittlement.

102 High component surface temperature precludes moisture accumulation that could result in corrosion.

103 The internal environment of these components is Fyrquel™, a phosphate ester used as a hydraulic fluid. For the purposes of aging evaluation, this environment is compared to the GALL environment of "Lubricating oil."

104 See LRA section 4.6.2, Main Steam Line Flow Restrictors Erosion Analysis.

Plant-Specific Notes (Continued)

105 The Compressed Air Monitoring program provides assurance that the quality of the "Air - dry" environment supports the conclusion that no aging effects are expected.

106 Conservatively assumed as high strength steel. Per the CMTR for all the heats used to fabricate the studs the highest yield strength is 142,500 psi, which is < 150 psi. Hence, none of the bolts require treatment as high strength steel.

107 This component type represents high strength, low alloy steel flange bolts servicing the Reactor Head Spray flange (N8). High-strength steel and steel bolting in the environments of air with reactor coolant leakage, Air, and System temperature up to 288°C (550°F) are considered equivalent for the aging effects of Loss of Material, Loss of Preload, and Cumulative Fatigue Damage.

108 This component type represents the CRD housings that consists of stainless steel and nickel components with the nickel pipe welded to the reactor vessel head.

109 Loss of material for the jet pump restrainer bracket and cast austenitic stainless steel jet pump wedges surface is aligned to GALL line item to address wear.

110 These components are the stainless steel boundary valves in the Reactor Coolant Pressure Boundary System exposed to sodium pentaborate solution.

111 Per Table 4-1, EPRI Report 1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tool. Revision 4, Appendix D, Nickel-Base Alloy aging effects are treated same as stainless steel in a dried air environment. The Compressed Air Monitoring program provides assurance that the quality of the "Air - dry" environment supports the conclusion that no aging effects are expected.

3.2 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES

3.2.1 INTRODUCTION

This section provides the results of the aging management review for those components identified in Section 2.3.2, Engineered Safety Features, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section are described in the indicated sections.

- Alternate Decay Heat Removal (Section 2.3.2.1)
- Annulus Exhaust Gas Treatment (Section 2.3.2.2)
- Containment Atmosphere Monitoring (Section 2.3.2.3)
- High Pressure Core Spray (Section 2.3.2.4)
- Low Pressure Core Spray (Section 2.3.2.5)
- Offgas (Section 2.3.2.6)
- Reactor Core Isolation Cooling (Section 2.3.2.7)
- Residual Heat Removal and Containment Spray (Section 2.3.2.8)
- Suppression Pool (Section 2.3.2.9)

3.2.2 RESULTS

The following tables summarize the results of the aging management review for the Engineered safety Features Systems.

- Table 3.2.2-1 Alternate Decay Heat Removal
- Table 3.2.2-2 Annulus Exhaust Gas Treatment
- Table 3.2.2-3 Containment Atmosphere Monitoring
- Table 3.2.2-4 High Pressure Core Spray
- Table 3.2.2-5 Low Pressure Core Spray
- Table 3.2.2-6 Offgas
- Table 3.2.2-7 Reactor Core Isolation Cooling
- Table 3.2.2-8 Residual Heat Removal and Containment Spray
- Table 3.2.2-9 Suppression Pool

3.2.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the engineered safety features systems components subject to aging management review. Programs are described in Appendix B. Further details are provided in the system tables.

3.2.2.1.1 Alternate Decay Heat Removal

Materials

Alternate Decay Heat Removal system components are constructed of the following materials:

- CASS
- Stainless steel
- Steel

Environments

Alternate Decay Heat Removal system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Alternate Decay Heat Removal system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Alternate Decay Heat Removal system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- One-Time Inspection (B.2.35)
- Open-Cycle Cooling Water System (B.2.37)
- Water Chemistry (B.2.44)

3.2.2.1.2 Annulus Exhaust Gas Treatment

Materials

Annulus Exhaust Gas Treatment system components are constructed of the following materials:

- Aluminum
- Copper alloy <15% Zn
- Elastomers
- Stainless steel
- Steel

Environments

Annulus Exhaust Gas Treatment system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Annulus Exhaust Gas Treatment system require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Annulus Exhaust Gas Treatment system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.2.2.1.3 Containment Atmosphere Monitoring

Materials

Containment Atmosphere Monitoring system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Containment Atmosphere Monitoring system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Containment Atmosphere Monitoring system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Containment Atmosphere Monitoring system components:

- Bolting Integrity (B.2.7)

3.2.2.1.4 High Pressure Core Spray

Materials

High Pressure Core Spray system components are constructed of the following materials:

- CASS
- Stainless steel
- Steel

Environments

High Pressure Core Spray system components are exposed to the following system environments: system

- Air – indoor, uncontrolled
- Lubricating oil
- Treated water
- Treated water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the High Pressure Core Spray system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on High Pressure Core Spray system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.2.2.1.5 Low Pressure Core Spray

Materials

Low Pressure Core Spray system components are constructed of the following materials:

- CASS
- Stainless steel
- Steel

Environments

Low Pressure Core Spray system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Lubricating oil
- Treated water

- Treated water >60˚C (>140˚F)

Aging Effects Requiring Management

The following aging effects associated with the Low Pressure Core Spray system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Low Pressure Core Spray system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.2.2.1.6 Offgas

Materials

Offgas system components are constructed of the following materials:

- CASS
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Gray cast iron
- Stainless steel
- Steel

Environments

Offgas system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Condensation
- Lubricating oil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Offgas system require management:

- Cracking
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Offgas system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- Water Chemistry (B.2.44)

3.2.2.1.7 Reactor Core Isolation Cooling

Materials

Reactor Core Isolation Cooling system components are constructed of the following materials:

- CASS
- Glass
- Gray cast iron
- Stainless steel
- Steel

Environments

Reactor Core Isolation Cooling system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Lubricating oil
- Treated water
- Treated water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the Reactor Core Isolation Cooling system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload
- Reduction of heat transfer

Aging Management Programs

The following aging management programs manage the effects of aging on Reactor Core Isolation Cooling system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.2.2.1.8 Residual Heat Removal and Containment Spray

Materials

Residual Heat Removal and Containment Spray system components are constructed of the following materials:

- CASS
- Stainless steel
- Steel
- Steel with stainless steel cladding

Environments

Residual Heat Removal and Containment Spray system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Lubricating oil
- Raw water
- Treated water
- Treated water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the Residual Heat Removal and Containment Spray system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload
- Reduction of heat transfer

Aging Management Programs

The following aging management programs manage the effects of aging on Residual Heat Removal and Containment Spray system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Open-Cycle Cooling Water System (B.2.37)
- TLAA
- Water Chemistry (B.2.44)

3.2.2.1.9 Suppression Pool

Materials

Suppression Pool system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Suppression Pool system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Suppression Pool system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Suppression Pool system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.2.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.2.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the PNPP approach to these areas requiring further evaluation. Programs are described in Appendix B.

Note - Italicized text at the beginning of each Further Evaluation subsection is taken directly from NUREG-1800 as supplemented by LR-ISG-2011-05 and LR-ISG-2012-02.

3.2.2.2.1 Cumulative Fatigue Damage

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-LR.

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of metal fatigue as a TLAA for non-Class 1 components in the Residual Heat Removal and Containment Spray, High Pressure Core Spray, Low Pressure Core Spray, and Reactor Core Isolation Cooling systems is discussed in Section 4.3.2 either specifically or as part of the global evaluation. Likewise, in addition, Metal fatigue for non-Class 1 components in the Auxiliary systems (Control and Computer Rooms Humidification System) is also addressed in Section 4.3.2. See Section 4.3 for a complete evaluation of metal fatigue.

3.2.2.2.2 Loss of Material due to Cladding Breach

Loss of material due to cladding breach could occur for PWR steel pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks, and recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

This paragraph in NUREG-1800 pertains to PWR steel charging pump casings with stainless steel cladding and is therefore not applicable to PNPP.

3.2.2.2.3 Loss of Material due to Pitting and Crevice Corrosion

1. *Loss of material due to pitting and crevice corrosion could occur in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).*

This paragraph in NUREG-1800 pertains to loss of material due to pitting and crevice corrosion in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. Although this paragraph is referenced only by a PWR table line (V.D1.E-01) in NUREG-1801, it could also apply to BWR plants. However, the ESF systems at PNPP do not include partially encased stainless steel tanks requiring aging management that are exposed to this environment. Therefore, this paragraph is not applicable.

2. *Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The possibility of pitting and crevice corrosion also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents. Pitting and crevice corrosion is only known to occur in environments containing sufficient sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible.*

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. At PNPP, there are no ESF system components requiring aging management review that are exposed to outdoor air. Therefore, this item was not used.

3.2.2.2.4 Loss of Material due to Erosion

Loss of material due to erosion could occur in the stainless steel high-pressure safety injection (HPSI) pump miniflow recirculation orifice exposed to treated borated water. The GALL Report recommends a plant-specific AMP be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. The GALL Report references Licensee Event Report (LER) 50-275/94-023 for evidence of erosion. Further evaluation is recommended to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).

This paragraph in NUREG-1800 pertains to PWR high pressure safety injection (HPSI) pump miniflow recirculation orifice and is therefore not applicable to PNPP.

3.2.2.2.5 Loss of Material due to General Corrosion and Fouling that Leads to Corrosion

Loss of material due to general corrosion and fouling that leads to corrosion can occur for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled. This could result in plugging of the spray nozzles and flow orifices. This aging mechanism and effect will apply since the spray nozzles and flow orifices are occasionally wetted, even though the majority of the time this system is on standby. The wetting and drying of these components can accelerate corrosion and fouling. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).

This item refers to loss of material due to general corrosion and fouling occurring for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to indoor air. PNPP has stainless steel orifices and spray nozzles subject to aging management with an internal, air-indoor, uncontrolled environment. There are no steel spray system flow orifices or nozzles subject to aging management in an internal, uncontrolled indoor air environment in Engineered Safety Features systems at PNPP. Therefore, this item is not used.

3.2.2.2.6 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements and tanks exposed to outdoor air. The possibility of cracking also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents. Cracking is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above. GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect. The applicant may demonstrate that this item is not applicable by describing the outdoor air environment present at the plant and demonstrating that external chloride stress corrosion cracking is not expected. The GALL Report recommends further evaluation to determine whether an aging management program is needed to manage this aging effect based on the environmental conditions applicable to the plant and requirements applicable to the components.

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. At PNPP, there are no ESF system components in the scope of license renewal that are exposed to outdoor air. Therefore, this item is not applicable.

3.2.2.2.7 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2 of this SRP-LR.)

See Appendix B Section B.1.3 for discussion of PNPP quality assurance procedures and administrative controls for aging management programs.

3.2.2.2.8 Ongoing Review of Operating Experience (Per LR-ISG-2011-05)

Ongoing review of operating experience is addressed in Appendix A section A.1 and Appendix B Section B.1.4

3.2.2.2.9 Loss of Material due to Recurring Internal Corrosion

Recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL Report. During the search of plant-specific OE conducted during the LRA development, recurring internal corrosion can be identified by the number of occurrences of aging effects and the extent of degradation at each localized corrosion site. This further evaluation item is applicable if the search of plant-specific OE reveals repetitive occurrences (e.g., one per refueling outage cycle that has occurred over: (a) three or more sequential or nonsequential cycles for a 10-year OE search, or (b) two or more sequential or nonsequential cycles for a 5-year OE search) of aging effects with the same aging mechanism in which the aging effect resulted in the component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness.

The GALL Report recommends that a plant-specific AMP, or a new or existing AMP, be evaluated for inclusion of augmented requirements to ensure the adequate management of any recurring aging effect(s). Potential augmented requirements include: alternative examination methods (e.g., volumetric versus external visual), augmented inspections (e.g., a greater number of locations, additional locations based on risk insights based on susceptibility to aging effect and consequences of failure, a greater frequency of inspections), and additional trending parameters and decision points where increased inspections would be implemented. Acceptance criteria are described in Appendix A.1, "Aging Management Review – Generic (Branch Technical Position RSLB-1)."

The applicant states: (a) why the program's examination methods will be sufficient to detect the recurring aging effect before affecting the ability of a component to perform its intended function, (b) the basis for the adequacy of augmented or lack of augmented inspections, (c) what parameters will be trended as well as the decision points where increased inspections would be implemented (e.g., the extent of degradation at individual corrosion sites, the rate of degradation change), (d) how inspections of components that are not easily accessed (i.e., buried, underground) will be conducted, and (e) how leaks in any involved buried or underground components will be identified.

Each plant-specific operating experience example should be evaluated to determine if the chosen AMP should be augmented even if the thresholds for significance of aging effect or frequency of occurrence of aging effect have not been exceeded. For example, during a 10-year search of plant specific operating experience, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the operating experience should be evaluated to determine if the AMP that is proposed to manage the aging *effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the CLB intended functions of the component will be met throughout the period of extended operation. Likewise, the GALL Report AMR items associated with the new FE items only cite raw water and waste water environments because OE indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific OE reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.*

LR-ISG-2012-02 has been issued which addresses instances of recurring internal corrosion identified during review of plant-specific operating experience. The operating experience for PNPP has been reviewed and the Engineered Safety Features systems have not exhibited instances of recurring internal corrosion with a frequency that is consistent with the thresholds discussed in LR-ISG-2012-02.

3.2.2.3 Time-Limited Aging Analyses

The time-limited aging analyses identified associated with ESF System components are addressed in Section 4. Table 4.1-2 provides TLAA results and identifies whether the TLAA remains valid for the PEO, will be managed during the PEO, and the LRA sections that address them.

3.2.3 CONCLUSION

The Engineered Safety Features piping, fittings, and components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage aging effects for the Engineered Safety Features components are identified in the summaries in Section 3.2.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Engineered Safety Features components will be adequately managed so that there is reasonable assurance that the intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-1	Stainless steel, Steel Piping, piping components, and piping elements exposed to Treated water (borated)	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA (See subsection 3.2.2.2.1)	Consistent with NUREG-1801. Cumulative fatigue damage is evaluated as a TLAA. In addition to components in the Engineered Safety Features systems, components in the Control Room and Computer Room Steam Humidification system are also aligned to this row. See further evaluation section 3.2.2.2.1.
3.2.1-2	PWR only				
3.2.1-3	PWR only				
3.2.1-4	Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated (See subsection 3.2.2.2.3)	Not applicable. At PNPP, there are no ESF system components subject to aging management that are exposed to air - outdoor. See further evaluation section 3.2.2.2.3.2.
3.2.1-5	PWR only				

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-6	Steel Drywell and suppression chamber spray system (internal surfaces): flow orifice; spray nozzles exposed to Air – indoor, uncontrolled (Internal)	Loss of material due to general corrosion; fouling that leads to corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific (See subsection 3.2.2.2.5)	Not applicable. There are no steel spray system flow orifices or nozzles subject to aging management in the Engineered Safety Features systems that are in an uncontrolled indoor air environment. See further evaluation section 3.2.2.2.5.
3.2.1-7	Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated (See subsection 3.2.2.2.6)	Not applicable. At PNPP, there are no ESF system components subject to aging management that are exposed to air - outdoor. Those portions of the High Pressure Core Spray system and Reactor Core Isolation system suction piping from the Condensate Storage Tank are scoped under the Condensate Transfer System and addressed under 3.4.1-63. Also see further evaluation section 3.2.2.2.6.
3.2.1-8	PWR only				
3.2.1-9	PWR only				

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-10	Cast austenitic stainless steel Piping, piping components, and piping elements exposed to Treated water (borated) >250˚C (>482˚F), Treated water >250˚C (>482˚F)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No	Not applicable. There are no cast austenitic stainless steel components subject to aging management review in the Engineered Safety Features systems that are exposed to treated water (borated) >250˚C (>482˚F) or treated water >250˚C (>482˚F).
3.2.1-11	Steel Piping, piping components, and piping elements exposed to Steam, Treated water	Wall thinning due to flow- accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801. The Flow-Accelerated Corrosion program will manage wall thinning (loss of material) due to flow-accelerated corrosion in steel components exposed to treated water. The "Treated water" environment in this application includes both liquid and vapor phases.
3.2.1-12	Steel, high-strength Closure bolting exposed to Air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity program will manage cracking of high-strength steel closure bolting in the Reactor Coolant Pressure Boundary and Reactor Vessel systems.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-13	Steel; stainless steel Bolting, Closure bolting exposed to Air – outdoor (External), Air – indoor, uncontrolled (External)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Loss of material of steel bolting exposed to air - indoor, uncontrolled environment will be managed by the Bolting Integrity program.
3.2.1-14	Steel Closure bolting exposed to Air with steam or water leakage	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	Not applicable. The "air with steam or water leakage" environment was not used in the Engineered Safety Features systems. Loss of material for bolting components in the Engineered Safety Features systems that are exposed to air environments is addressed in items 3.2.1-13 and 3.3.1-12

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-15	Copper alloy, Nickel alloy, Steel; stainless steel, Stainless steel, Steel; stainless steel Bolting, Closure bolting exposed to Any environment, Air – outdoor (External), Raw water, Treated borated water, Fuel oil, Treated water, Air – indoor, uncontrolled (External)	Loss of preload due to thermal effects, gasket creep, and self- loosening	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity program will manage loss of preload for steel and stainless steel bolting in air - indoor uncontrolled and in treated water. Additionally, loss of preload for steel bolting in condensation environment is managed by the Bolting Integrity program and aligned to this row, because condensation is considered to be equivalent to Air - outdoor for evaluation of GALL consistency for Loss of preload for steel bolting.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-16	Steel Containment isolation piping and components (Internal surfaces), Piping, piping components, and piping elements exposed to Treated water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One- Time Inspection"	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage loss of material for steel components exposed to treated water, and the One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. In addition to components in the Engineered Safety Features systems, some components in the Nuclear Boiler, Reactor Recirculation and Reactor Coolant Pressure Boundary systems are also aligned to this row. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-17	Aluminum, Stainless steel Piping, piping components, and piping elements exposed to Treated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One- Time Inspection”	No	Consistent with NUREG-1801 for most components, with a different program for submerged bolting, and some program exceptions. The Water Chemistry program will manage loss of material for stainless steel components exposed to treated water, and the One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. The Bolting Integrity program will manage loss of material for stainless steel suppression pool strainer bolting submerged in treated water. In addition to the Engineering Safety Features systems, the aluminum, upper containment pool gates in the Containment Structure and aluminum component and piping supports in the spent fuel pool (Bulk Civil Commodities) are also aligned with this item. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-18	Stainless steel Containment isolation piping and components (Internal surfaces) exposed to Treated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One- Time Inspection”	No	Not applicable. Management of loss of material for stainless steel components in the Engineered Safety Features systems that are exposed to treated water is aligned to items 3.2.1-16 and 3.2.1-17.
3.2.1-19 (LR-ISG-2011-01)	Stainless steel Heat exchanger tubes exposed to Treated water, Treated water (borated)	Reduction of heat transfer due to fouling	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One- Time Inspection”	No	Consistent with NUREG-1801 (as modified by LR-ISG-2011-01) with some program exceptions. The Water Chemistry program will manage reduction of heat transfer for stainless steel heat exchanger tubes and tube sheets exposed to treated water, and the One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.2.1-20 (LR-ISG-2011-01)	PWR only				
3.2.1-21 (LR-ISG-2011-01)	PWR only				

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-22 (LR-ISG-2011-01)	PWR only				
3.2.1-23	Steel Heat exchanger components, Containment isolation piping and components (Internal surfaces) exposed to Raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System program will manage loss of material for steel heat exchanger components exposed to raw water.
3.2.1-24	PWR only				
3.2.1-25	Stainless steel Heat exchanger components, Containment isolation piping and components (Internal surfaces) exposed to Raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System program will manage loss of material for stainless steel heat exchanger components exposed to raw water.
3.2.1-26	Stainless steel Heat exchanger tubes exposed to Raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System program will manage reduction of heat transfer for stainless steel heat exchanger tubes exposed to raw water.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-27	Stainless steel, Steel Heat exchanger tubes exposed to Raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no steel heat exchanger tubes subject to aging management review in the Engineered Safety Features systems that are exposed to raw water. Management of reduction of heat transfer for stainless steel heat exchanger tubes exposed to raw water is addressed in item 3.2.1-26.
3.2.1-28	Stainless steel Piping, piping components, and piping elements exposed to Closed-cycle cooling water >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no stainless steel components subject to aging management review in the Engineered Safety Features systems that are exposed to closed-cycle cooling water >60˚C (>140˚F). Stainless steel piping components in ESF systems exposed to treated water >60˚C (>140˚F) are addressed under 3.4.1-11.
3.2.1-29	Steel Piping, piping components, and piping elements exposed to Closed-cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no steel piping components subject to aging management review in the Engineered Safety Features systems that are exposed to closed-cycle cooling water.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-30	Steel Heat exchanger components exposed to Closed-cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. The Closed Treated Water Systems program will manage loss of material due to mechanisms other than selective leaching for gray cast iron heat exchanger components exposed to closed- cycle cooling water.
3.2.1-31	Stainless steel Heat exchanger components, Piping, piping components, and piping elements exposed to Closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. No components from the Engineered Safety Features systems are aligned to this row, but the Closed Treated Water Systems program will manage loss of material for the stainless steel Recirculation Pump seal coolers that are exposed to closed-cycle cooling water.
3.2.1-32	Copper alloy Heat exchanger components, Piping, piping components, and piping elements exposed to Closed-cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no copper alloy Engineered Safety Features systems components subject to aging management review that are exposed to closed-cycle cooling water.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-33	Copper alloy, Stainless steel Heat exchanger tubes exposed to Closed-cycle cooling water	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no copper alloy or stainless steel Engineered Safety Features systems heat exchanger tubes subject to aging management review that are exposed to closed-cycle cooling water.
3.2.1-34	Copper alloy (>15% Zn or >8% Al) Piping, piping components, and piping elements, Heat exchanger components exposed to Closed-cycle cooling water	Loss of material due to selective leaching	Chapter XI.M33, “Selective Leaching”	No	Not applicable. There are no copper alloy (>15% Zn or >8% Al) Engineered Safety Features systems components subject to aging management review that are exposed to closed-cycle cooling water.
3.2.1-35	PWR only				
3.2.1-36	PWR only				
3.2.1-37	Gray cast iron Piping, piping components, and piping elements exposed to Soil	Loss of material due to selective leaching	Chapter XI.M33, “Selective Leaching”	No	Not applicable. There are no gray cast iron Engineered Safety Features systems components subject to aging management review that are exposed to soil.
3.2.1-38	Elastomers Elastomer seals and components exposed to Air – indoor, uncontrolled (External)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. The External Surfaces Monitoring of Mechanical Components program will manage hardening and loss of strength of elastomer flexible ventilation connections.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-39	Steel Containment isolation piping and components (External surfaces) exposed to Condensation (External)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. Steel piping components exposed to condensation in the Engineered Safety Features systems are addressed by item 3.2.1-69.
3.2.1-40	Steel Ducting, piping, and components (External surfaces), Ducting, closure bolting, Containment isolation piping and components (External surfaces) exposed to Air – indoor, uncontrolled (External)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801 for most components. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for the Engineered Safety Features system steel piping, ducting and heat exchanger components exposed to an external environment of air - indoor, uncontrolled. The refueling bellows is aligned to this row, and is normally exposed to air-indoor, uncontrolled on both surfaces. The upper surface is exposed to treated water infrequently (during fuel movement) and is accessible when the upper pool is drained down. Because the lower surface is not exposed to fluid, the condition of the upper surface is expected to be representative of (or worse than) the lower surface.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Inspections of the upper surface will manage loss of material for both surfaces. In addition to the Engineering Safety Features systems, some steel components exposed to an air - indoor uncontrolled environment in the Nuclear Boiler and the Reactor Coolant Pressure Boundary systems are also aligned to this row. In addition, the reactor vessel support skirt in the Reactor Vessel system is aligned to this row with an aging evaluation that is consistent for material, environment and aging effect, but with a different program assignment. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program will manage loss of material for the support skirt.
3.2.1-41	Steel External surfaces exposed to Air – outdoor (External)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. There are no steel Engineered Safety Features systems components subject to aging management review that are exposed to an air - outdoor environment.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-42	Aluminum Piping, piping components, and piping elements exposed to Air - outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. There are no aluminum Engineered Safety Features systems components subject to aging management review that are exposed to an air - outdoor environment.
3.2.1-43	Elastomers Elastomer seals and components exposed to Air – indoor, uncontrolled (Internal)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable. The Annulus Exhaust Gas Treatment system elastomer flexible ventilation connections have an internal environment of air - indoor, uncontrolled, but are aligned to item 3.3.1-76. There are no other elastomer Engineered Safety Features systems components subject to aging management review that are exposed to an air - indoor, uncontrolled internal environment.
3.2.1-44	Steel Piping and components (Internal surfaces), Ducting and components (Internal surfaces) exposed to Air – indoor, uncontrolled (Internal)	Loss of material due to general corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801 for most components. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components will manage loss of material for most steel components exposed to an internal environment of air – indoor, uncontrolled. In addition to components in the Engineered Safety Features systems,

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					components from numerous other systems are also aligned to this row with management by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. Some components are consistent for material, environment and aging effect, but a different program is used: the External Surfaces Monitoring of Mechanical Components program will manage internal surfaces of permanently drained components in the Emergency Closed Cooling Water system that perform a structural integrity function, but do not perform a pressure boundary or leakage boundary function. Externally observable aging effects for these components are expected to be representative of the internal conditions.
3.2.1-45	PWR only				

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-46	Steel Piping and components (Internal surfaces) exposed to Condensation (Internal)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable. There are no steel Engineered Safety Features systems piping components subject to aging management review that are exposed to an internal environment of condensation.
3.2.1-47	PWR only				
3.2.1-48	Stainless steel Piping, piping components, and piping elements (Internal surfaces); tanks exposed to Condensation (Internal)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. There are no stainless steel Engineered Safety Features systems components subject to aging management that are exposed to an internal environment of condensation. However, components from the Leakage Detection system are aligned to this row. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for these stainless steel components exposed to internal condensation.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-49	Steel Piping, piping components, and piping elements exposed to Lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. The Lubricating Oil Analysis program will manage loss of material for steel components exposed to lubricating oil, and the One-Time Inspection program will be used to confirm the effectiveness of the Lubricating Oil Analysis program. The environment for some components in the Offgas system is 3M NOVEC™ 7100 refrigerant, a fluorinated hydrocarbon. This refrigerant is a liquid at room temperature and is compatible with metals. For the purpose of aging management comparison, this fluid is similar to lubricating oil. Materials susceptible to selective leaching subjected to water contaminated fuel oil and water-contaminated lube oil are managed under the Lubricating Oil Analysis and Fuel Oil Chemistry programs. These programs assure the exclusion of water. Furthermore, NUREG 2191 Selective Leaching AMP no longer includes water contaminated fuel oil and lube oil environments.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-50	Copper alloy, Stainless steel Piping, piping components, and piping elements exposed to Lubricating oil	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. The Lubricating Oil Analysis program will manage loss of material for copper alloy components exposed to lubricating oil, and the One-Time Inspection program will be used to confirm the effectiveness of the Lubricating Oil Analysis program. The environment for some components in the Offgas system is 3M NOVEC™ 7100 refrigerant, a fluorinated hydrocarbon. This refrigerant is a liquid at room temperature and is compatible with metals. For the purpose of aging management comparison, this fluid is similar to lubricating oil. Loss of material for stainless steel in lubricating oil is addressed in items 3.3.1-100 and 3.4.1-44.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-51	Steel, Copper alloy, Stainless steel Heat exchanger tubes exposed to Lubricating oil	Reduction of heat transfer due to fouling	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. The Lubricating Oil Analysis program will manage reduction of heat transfer for copper alloy and stainless steel heat exchanger tubes and tube sheets exposed to lubricating oil, and the One-Time Inspection program will be used to confirm the effectiveness of the Lubricating Oil Analysis program. In addition to components in the Engineered Safety Features systems, the Lubricating Oil Analysis program (with One-Time Inspection to confirm the effectiveness of the Lubricating Oil Analysis program) will manage reduction of heat transfer for copper alloy and stainless steel heat exchanger tubes from the following systems: Emergency Service Water, Control Complex Chilled Water, Combustible Gas Control, and Diesel Generator Cooling Water. There are no steel heat exchanger tubes subject to aging management review that are exposed to lubricating oil in the Engineered Safety Features systems.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-52	Steel (with coating or wrapping) Piping, piping components, and piping elements exposed to Soil or Concrete	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There are no steel components subject to aging management review in the Engineered Safety Features systems that are exposed to an environment of soil or concrete.
3.2.1-53 (LR-ISG-2011-03)	Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There are no stainless steel or nickel alloy piping components subject to aging management in the Engineered Safety Features systems that are exposed to an environment of soil or concrete.
3.2.1-53x (LR-ISG-2011-03)	Steel, stainless steel, nickel alloy underground piping, piping components, and piping elements exposed to air-indoor uncontrolled or condensation (external)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There are no underground piping components subject to aging management review for loss of material in the Engineered Safety Features systems that are exposed to an environment of air-indoor uncontrolled or condensation.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-54	Stainless steel Piping, piping components, and piping elements exposed to Treated water >60˚C (>140˚F)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	Not applicable. There are no stainless steel Engineered Safety Features systems piping components aligned to this row. Stainless steel piping components in the Engineering Safety Systems Components exposed to Treated water >60˚C (>140˚F) are age managed for Cracking due to stress corrosion cracking in item 3.4.1-11.
3.2.1-55	Steel Piping, piping components, and piping elements exposed to Concrete	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Not applicable. There are no steel piping components subject to aging management in the Engineered Safety Features systems that are exposed to an environment of concrete.
3.2.1-56	Aluminum Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (Internal/External)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. Components in the Annulus Exhaust Gas Treatment system are aligned to this row.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-57	Copper alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External), Gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for copper alloy piping components in the Engineered Safety Features systems exposed to air - indoor, uncontrolled. There are no copper alloy piping components subject to aging management review in the Engineered Safety Features systems that are exposed to an environment of gas.
3.2.1-58	PWR only				
3.2.1-59	Galvanized steel Ducting, piping, and components exposed to Air – indoor, controlled (External)	None	None	NA - No AEM or AMP	Not applicable. There are no galvanized steel ducting, piping, and components subject to aging management review in the Engineered Safety Features systems exposed to Air - indoor controlled environment. Galvanized steel ducting, piping, and components subject to aging management review in the Engineered Safety Features systems were evaluated as steel in air - indoor, uncontrolled, and are addressed in item 3.2.1-40.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-60	Glass Piping elements exposed to Air – indoor, uncontrolled (External), Lubricating oil, Raw water, Treated water, Treated water (borated), Air with borated water leakage, Condensation (Internal/External), Gas, Closed- cycle cooling water, Air – outdoor	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for glass components in the Engineered Safety Features systems exposed to air - indoor uncontrolled, lubricating oil and condensation. The environment for some components in the Offgas system is 3M NOVEC™ 7100 refrigerant, a fluorinated hydrocarbon. For the purpose of aging management comparison, this fluid is similar to lubricating oil. Glass components subject to aging management review in the Engineered Safety Features systems are not exposed to other environments.
3.2.1-61	Nickel alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External)	None	None	NA - No AEM or AMP	Not applicable. There are no nickel alloy piping components subject to aging management review in the Engineered Safety Features systems that are exposed to an environment of air - indoor, uncontrolled.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-62	Nickel alloy Piping, piping components, and piping elements exposed to Air with borated water leakage	None	None	NA - No AEM or AMP	Not applicable. There are no nickel alloy piping components subject to aging management review in the Engineered Safety Features systems that are exposed to an environment of air with borated water leakage.
3.2.1-63	Stainless steel Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External), Air with borated water leakage, Concrete, Gas, Air – indoor, uncontrolled (Internal)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for stainless steel components exposed to air - indoor, uncontrolled (internal and external). Stainless steel components subject to aging management review in the Engineered Safety Features systems are not exposed to air with borated water leakage, concrete, or gas. Reactor vessel internal component type Dry Tube assembly is also aligned with this item. In addition to the Engineering Safety Features systems, the stainless steel, containment vessel electrical penetrations commodity in the Containment Structure is aligned with this item.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-64	Steel Piping, piping components, and piping elements exposed to Air – indoor, controlled (External), Gas	None	None	NA - No AEM or AMP	Not applicable. There are no steel piping components subject to aging management review in the Engineered Safety Features systems that are exposed to an environment of air - indoor, controlled or gas.
3.2.1-65 (LR-ISG-2012-01)	Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated)	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-01). The Flow-Accelerated Corrosion program will manage wall thinning (loss of material) due to erosion for piping components in the Residual Heat Removal, Low Pressure Core Spray and High Pressure Core Spray systems for which OE indicates the potential for erosion.
3.2.1-66 (LR-ISG-2012-02)	Metallic piping, piping components, and tanks exposed to raw water or waste water	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion	Yes, plant-specific (See Subsection 3.2.2.2.9)	Not applicable. Metallic piping components in Engineered Safety Features systems subject to aging management for loss of material and exposed to raw water or waste water are addressed in item 3.3.1-91. See subsection 3.2.2.2.9.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-67 (LR-ISG-2012-02)	Stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Cracking due to stress corrosion cracking	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not applicable. There are no stainless steel or aluminum tanks within the scope of the XI.M29 Aboveground Metallic Tanks program in the Engineered Safety Features systems.
3.2.1-68 (LR-ISG-2012-02)	Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not applicable. There are no steel, stainless steel or aluminum tanks within the scope of the XI.M29 Aboveground Metallic Tanks program in the Engineered Safety Features systems.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-69 (LR-ISG-2012-02)	Insulated steel, stainless steel, copper alloy, or aluminum, piping, piping components, and tanks exposed to condensation, air-outdoor	Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, “Aboveground Metallic Tanks,” (for tanks only)	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The External Surfaces Monitoring of Mechanical Components program will manage loss of material for insulated steel (including gray cast iron), stainless steel and copper alloy components exposed to condensation. There are no insulated steel, stainless steel or copper alloy components in the Engineered Safety Features systems that are exposed to air - outdoor. There are no tanks within the scope of the XI.M29 Aboveground Metallic Tanks program in the Engineered Safety Features systems.
3.2.1-70 (LR-ISG-2012-02)	Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, “Aboveground Metallic Tanks”) exposed to treated water, treated borated water	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not applicable. There are no steel, stainless steel or aluminum tanks within the scope of the XI.M29 Aboveground Metallic Tanks program in the Engineered Safety Features systems.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-71 (LR-ISG-2012-02)	Insulated stainless steel, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks," (for tanks only)	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The External Surfaces Monitoring of Mechanical Components program will manage cracking of insulated stainless steel components exposed to condensation. There are no tanks within the scope of the XI.M29 Aboveground Metallic Tanks program in the Engineered Safety Features systems. In addition to the Engineering Safety Features systems, the External Surfaces Monitoring of Mechanical Components program will manage cracking of aluminum insulation jacketing commodity exposed to air-outdoor in the Bulk Civil Commodities. However, Structures Monitoring program will manage cracking for aluminum components of metal siding, windows, conduits, damper and louver housings and fixed louvers1, and flood curbs exposed to air-outdoor in the Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures and Bulk Civil Commodities.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-72 (LR-ISG-2013-01)	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coating/linings.	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not applicable. There are no metallic components identified in the Engineered Safety Features systems with coatings or linings exposed to liquid environments.
3.2.1-73 (LR-ISG-2013-01)	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not applicable. There are no metallic components identified in the Engineered Safety Features systems with coatings or linings exposed to liquid environments.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-74 (LR-ISG-2013-01)	Gray cast iron piping component with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not applicable. There are no metallic components identified in the Engineered Safety Features systems with coatings or linings exposed to liquid environments.

Table 3.2.2-1
Engineered Safety Features Systems – Alternate Decay Heat Removal
Summary of Aging Management Evaluation

Table 3.2.2-1 - Alternate Decay Heat Removal System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
5	Heat exchanger (Plate)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
6	Heat exchanger (Plate)	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	V.D2.EP-91	3.2.1-25	A
7	Heat exchanger (Plate)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	D
8	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
9	Orifice	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
10	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
11	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-1 - Alternate Decay Heat Removal System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
12	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
13	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
14	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
15	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
16	Pump casing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
17	Pump casing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
18	Valve body	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
19	Valve body	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
20	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
21	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
22	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A

Table 3.2.2-1 - Alternate Decay Heat Removal System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
23	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
24	Valve body	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
25	Valve body	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
26	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
27	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.2.2-2
Engineered Safety Features Systems – Annulus Exhaust Gas Treatment
Summary of Aging Management Evaluation

Table 3.2.2-2 - Annulus Exhaust Gas Treatment System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
5	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
6	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.2.2-2 - Annulus Exhaust Gas Treatment System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
7	Duct	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-3	3.2.1-56	C
8	Duct	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-3	3.2.1-56	C
9	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
10	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
11	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
12	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
13	Filter housing	Filtration	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	C

Table 3.2.2-2 - Annulus Exhaust Gas Treatment System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
14	Filter housing	Filtration	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	C
15	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
16	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
17	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	V.B.EP-59	3.2.1-38	A
18	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F3.AP-102	3.3.1-76	A
19	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-113	3.3.1-82	A

Table 3.2.2-2 - Annulus Exhaust Gas Treatment System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
20	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-103	3.3.1-96	A, 205
21	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
22	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
23	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
24	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
25	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-10	3.2.1-57	A

Table 3.2.2-2 - Annulus Exhaust Gas Treatment System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
26	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A
27	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
28	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
29	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
30	Piping	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
31	Valve body	Pressure Boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-10	3.2.1-57	A
32	Valve body	Pressure Boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A
33	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A

Table 3.2.2-2 - Annulus Exhaust Gas Treatment System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
34	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
35	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
36	Valve body	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.2.2-3
Engineered Safety Features Systems – Containment Atmosphere Monitoring
Summary of Aging Management Evaluation

Table 3.2.2-3 - Containment Atmosphere Monitoring System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
3	Orifice	Flow restriction	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
4	Orifice	Flow restriction	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
5	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
6	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
7	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
8	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A

Table 3.2.2-4
Engineered Safety Features Systems – High Pressure Core Spray
Summary of Aging Management Evaluation

Table 3.2.2-4 - High Pressure Core Spray System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
5	Cyclone separator	Filtration, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
6	Cyclone separator	Filtration, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
7	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
8	Flexible hose	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
9	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
10	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A

Table 3.2.2-4 - High Pressure Core Spray System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
12	Orifice	Flow restriction, Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
13	Orifice	Flow restriction, Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
14	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
15	Orifice	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
16	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
17	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408 (LR-ISG-2012-01)	3.2.1-65	A
18	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
19	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
20	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A

Table 3.2.2-4 - High Pressure Core Spray System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
21	Piping	Pressure boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
22	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
23	Piping	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
24	Piping	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
25	Piping	Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
26	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
27	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
28	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
29	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408 (LR-ISG-2012-01)	3.2.1-65	A
30	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.2.2-4 - High Pressure Core Spray System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
31	Pump casing	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
32	Pump casing	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
33	Pump casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
34	Pump casing	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
35	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
36	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
37	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
38	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
39	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.D2.SP-95	3.4.1-44	A
40	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-4 - High Pressure Core Spray System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
41	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
42	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
43	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408 (LR-ISG-2012-01)	3.2.1-65	A
44	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.2.2-5
Engineered Safety Features Systems – Low Pressure Core Spray
Summary of Aging Management Evaluation

Table 3.2.2-5 - Low Pressure Core Spray System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
5	Cyclone separator	Filtration, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
6	Cyclone separator	Filtration, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
7	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
8	Flexible hose	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-5 - Low Pressure Core Spray System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
10	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
11	Orifice	Flow restriction, Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
12	Orifice	Flow restriction, Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
13	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
14	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
15	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
16	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-5 - Low Pressure Core Spray System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
17	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
18	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
19	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
20	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
21	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
22	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408 (LR-ISG-2012-01)	3.2.1-65	A
23	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
24	Pump casing	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
25	Pump casing	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-5 - Low Pressure Core Spray System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
26	Pump casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
27	Pump casing	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
28	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
29	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
30	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
31	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.D2.SP-95	3.4.1-44	A
32	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
33	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A

Table 3.2.2-5 - Low Pressure Core Spray System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
34	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
35	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408 (LR-ISG-2012-01)	3.2.1-65	A
36	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.2.2-6
Engineered Safety Features Systems – Offgas
Summary of Aging Management Evaluation

Table 3.2.2-6 - Offgas System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
3	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
4	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	V.E.EP-118	3.2.1-15	A, 203
5	Filter housing	Leakage boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
6	Filter housing	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-76	3.2.1-50	A, 201
7	Filter housing	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
8	Filter housing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and	V.D2.EP-77	3.2.1-49	A, 201

Table 3.2.2-6 - Offgas System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
						One-Time Inspection			
9	Heat exchanger (Channel)	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	V.D2.EP-92	3.2.1-30	A
10	Heat exchanger (Channel)	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	D
11	Heat exchanger (Channel)	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	C
12	Heat exchanger (Channel)	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	Selective Leaching	VII.C1.A-51	3.3.1-72	D, 204
13	Heat exchanger (Channel)	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	C
14	Heat exchanger (Channel)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
15	Heat exchanger (Shell)	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	C

Table 3.2.2-6 - Offgas System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
16	Heat exchanger (Shell)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	C, 201
17	Heat exchanger (Shell)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
18	Moisture separator	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
19	Moisture separator	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
20	Oil receiver	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
21	Oil receiver	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A
22	Oil separator	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
23	Oil separator	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and	V.D2.EP-77	3.2.1-49	A

Table 3.2.2-6 - Offgas System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
						One-Time Inspection			
24	Orifice	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	V.B.E-406 (LR-ISG-2012-02)	3.2.1-71	A
25	Orifice	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
26	Orifice	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.A.SP-95	3.4.1-44	A, 201
27	Piping	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-10	3.2.1-57	A
28	Piping	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-76	3.2.1-50	A
29	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
30	Piping	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	V.B.E-406 (LR-ISG-2012-02)	3.2.1-71	A

Table 3.2.2-6 - Offgas System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
31	Piping	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
32	Piping	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.A.SP-95	3.4.1-44	A, 201
33	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
34	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A
35	Piping	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
36	Piping	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A
37	Piping	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A, 201

Table 3.2.2-6 - Offgas System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
38	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
39	Pump casing	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
40	Pump casing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A, 201
41	Pump casing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
42	Sight glass	Leakage boundary	Glass	Condensation (Ext)	None	None	V.F.EP-66	3.2.1-60	A
43	Sight glass	Leakage boundary	Glass	Lubricating oil (Int)	None	None	V.F.EP-16	3.2.1-60	A, 201
44	Sight glass (Body)	Leakage boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
45	Sight glass (Body)	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-76	3.2.1-50	A, 201
46	Sight glass (Body)	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A

Table 3.2.2-6 - Offgas System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
						Mechanical Components			
47	Sight glass (Body)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A, 201
48	Strainer body	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
49	Strainer body	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
50	Strainer body	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
51	Strainer body	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	Selective Leaching	VII.C1.A-51	3.3.1-72	B, 204
52	Strainer body	Leakage boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A, 201
53	Tank	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
54	Tank	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and	V.D2.EP-77	3.2.1-49	C, 201

Table 3.2.2-6 - Offgas System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
						One-Time Inspection			
55	Tank	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	D
56	Valve body	Leakage boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
57	Valve body	Leakage boundary	Copper alloy <15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.A.SP-101	3.4.1-16	B
58	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-10	3.2.1-57	A
59	Valve body	Leakage boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-76	3.2.1-50	A
60	Valve body	Leakage boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-76	3.2.1-50	A, 201
61	Valve body	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A

Table 3.2.2-6 - Offgas System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
62	Valve body	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	Selective Leaching	VII.C1.A-51	3.3.1-72	B, 204
63	Valve body	Leakage boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A, 201
64	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
65	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	V.B.E-406 (LR-ISG-2012-02)	3.2.1-71	A
66	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
67	Valve body	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.A.SP-95	3.4.1-44	A, 201
68	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
69	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-26	3.2.1-40	A

Table 3.2.2-6 - Offgas System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
70	Valve body	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	A
71	Valve body	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A
72	Valve body	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A, 201
73	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
74	Ventilation cooler (Header)	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	C
75	Ventilation cooler (Header)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	C, 201
76	Ventilation cooler (Tube)	Leakage boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.B.E-403 (LR-ISG-2012-02)	3.2.1-69	C

Table 3.2.2-6 - Offgas System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
77	Ventilation cooler (Tube)	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-76	3.2.1-50	C, 201

Table 3.2.2-7
Engineered Safety Features Systems – Reactor Core Isolation Cooling
Summary of Aging Management Evaluation

Table 3.2.2-7 - Reactor Core Isolation Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Accumulator	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
2	Accumulator	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
3	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
4	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	A
6	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
7	Cooler (Channel)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
8	Cooler (Channel)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	D

Table 3.2.2-7 - Reactor Core Isolation Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Cooler (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	C
10	Cooler (Shell)	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	C
11	Cooler (Tube)	Heat transfer, Pressure boundary	Stainless steel	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.D2.SP-95	3.4.1-44	C
12	Cooler (Tube)	Heat transfer, Pressure boundary	Stainless steel	Lubricating oil (Ext)	Reduction of heat transfer	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-79	3.2.1-51	A
13	Cooler (Tube)	Heat transfer, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	D
14	Cooler (Tube)	Heat transfer, Pressure boundary	Stainless steel	Treated water (Int)	Reduction of heat transfer	Water Chemistry and One-Time Inspection	V.D2.EP-74	3.2.1-19	B
15	Cooler (Tubesheet)	Pressure boundary	Stainless steel	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.D2.SP-95	3.4.1-44	C
16	Cooler (Tubesheet)	Pressure boundary	Stainless steel	Lubricating oil (Ext)	Reduction of heat transfer	Lubricating Oil Analysis and	V.D2.EP-79	3.2.1-51	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
						One-Time Inspection			
17	Cooler (Tubesheet)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	D
18	Cooler (Tubesheet)	Pressure boundary	Stainless steel	Treated water (Int)	Reduction of heat transfer	Water Chemistry and One-Time Inspection	V.D2.EP-74	3.2.1-19	B
19	Cyclone separator	Filtration, Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
20	Cyclone separator	Filtration, Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
21	Drain pot	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
22	Drain pot	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
23	Drain pot	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
24	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of	V.D2.E-26	3.2.1-40	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
						Mechanical Components			
25	Filter housing	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A
26	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
27	Flexible hose	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
28	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
29	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
30	Orifice	Flow restriction, Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.D2.SP-95	3.4.1-44	A
31	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-7 - Reactor Core Isolation Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
32	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
33	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
34	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
35	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
36	Orifice	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
37	Orifice	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
38	Orifice	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
39	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
40	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-7 - Reactor Core Isolation Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
41	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
42	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
43	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
44	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
45	Piping	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
46	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09	3.2.1-11	A
47	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
48	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
49	Piping	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.D2.SP-95	3.4.1-44	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
50	Piping	Pressure boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
51	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
52	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
53	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
54	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
55	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
56	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
57	Piping	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
58	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
59	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09	3.2.1-11	A
60	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
61	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
62	Pump casing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
63	Pump casing	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
64	Pump casing	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
65	Pump casing	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
66	Pump casing	Pressure boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
67	Pump casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
68	Pump casing	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
69	Rupture disc	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
70	Rupture disc	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
71	Rupture disc	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
72	Rupture disc	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
73	Rupture disc	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
74	Sight glass	Pressure boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-15	3.2.1-60	A
75	Sight glass	Pressure boundary	Glass	Lubricating oil (Int)	None	None	V.F.EP-16	3.2.1-60	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
76	Sight glass (Body)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
77	Sight glass (Body)	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A
78	Sparger (Turbine exhaust)	Direct flow	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
79	Sparger (Turbine exhaust)	Direct flow	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
80	Sparger (Turbine exhaust)	Direct flow	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
81	Sparger (Turbine exhaust)	Direct flow	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
82	Strainer body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
83	Strainer body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
84	Strainer body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
85	Turbine casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
86	Turbine casing	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
87	Turbine casing	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
88	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
89	Valve body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
90	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09	3.2.1-11	A
91	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
92	Valve body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
93	Valve body	Pressure boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A
94	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
95	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.D2.SP-95	3.4.1-44	A
96	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
97	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
98	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
99	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
100	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A

Table 3.2.2-7 - Reactor Core Isolation Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
101	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
102	Valve body	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-77	3.2.1-49	A
103	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
104	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09	3.2.1-11	A
105	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.2.2-8
Engineered Safety Features Systems – Residual Heat Removal and Containment Spray
Summary of Aging Management Evaluation

Table 3.2.2-8 - Residual Heat Removal and Containment Spray Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	C
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	C
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	A
5	Cyclone separator	Filtration, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
6	Cyclone separator	Filtration, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
7	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
8	Flexible hose	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-8 - Residual Heat Removal and Containment Spray Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Heat exchanger (Channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	C
10	Heat exchanger (Channel)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	V.D2.EP-90	3.2.1-23	A
11	Heat exchanger (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	C
12	Heat exchanger (Shell)	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	C
13	Heat exchanger (Shell)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	D
14	Heat exchanger (Tube)	Pressure boundary, Heat transfer	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	V.D2.EP-91	3.2.1-25	A
15	Heat exchanger (Tube)	Pressure boundary, Heat transfer	Stainless steel	Raw water (Int)	Reduction of heat transfer	Open-Cycle Cooling Water System	V.D2.E-21	3.2.1-26	A
16	Heat exchanger (Tube)	Pressure boundary, Heat transfer	Stainless steel	Treated water >60°C (>140°F) (Ext)	Cracking	Water Chemistry and One-Time Inspection	VII.E3.AP-112	3.3.1-20	B

Table 3.2.2-8 - Residual Heat Removal and Containment Spray Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
17	Heat exchanger (Tube)	Pressure boundary, Heat transfer	Stainless steel	Treated water >60˚C (>140˚F) (Ext)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	C
18	Heat exchanger (Tube)	Pressure boundary, Heat transfer	Stainless steel	Treated water >60˚C (>140˚F) (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	D
19	Heat exchanger (Tube)	Pressure boundary, Heat transfer	Stainless steel	Treated water >60˚C (>140˚F) (Ext)	Reduction of heat transfer	Water Chemistry and One-Time Inspection	V.D2.EP-74	3.2.1-19	B
20	Heat exchanger (Tubesheet)	Pressure boundary	Steel with stainless steel cladding	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	V.D2.EP-91	3.2.1-25	A
21	Heat exchanger (Tubesheet)	Pressure boundary	Steel with stainless steel cladding	Treated water (Ext)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	C
22	Heat exchanger (Tubesheet)	Pressure boundary	Steel with stainless steel cladding	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	D
23	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A

Table 3.2.2-8 - Residual Heat Removal and Containment Spray Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
24	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
25	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
26	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
27	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
28	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
29	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
30	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
31	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.2.2-8 - Residual Heat Removal and Containment Spray Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
32	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
33	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
34	Piping	Pressure boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
35	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
36	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
37	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
38	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
39	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
40	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A

Table 3.2.2-8 - Residual Heat Removal and Containment Spray Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
41	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
42	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09	3.2.1-11	A
43	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408 (LR-ISG-2012-01)	3.2.1-65	A
44	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
45	Pump casing	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
46	Pump casing	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
47	Pump casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
48	Pump casing	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
49	Pump casing	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
50	Spray nozzle	Spray	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A

Table 3.2.2-8 - Residual Heat Removal and Containment Spray Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
51	Spray nozzle	Spray	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
52	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
53	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
54	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
55	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B
56	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
57	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	V.F.EP-82	3.2.1-63	A
58	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VIII.D2.SP-95	3.4.1-44	A
59	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Table 3.2.2-8 - Residual Heat Removal and Containment Spray Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
60	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A
61	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
62	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
63	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09	3.2.1-11	A
64	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408 (LR-ISG-2012-01)	3.2.1-65	A
65	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-60	3.2.1-16	B

Table 3.2.2-9
Engineered Safety Features Systems – Suppression Pool
Summary of Aging Management Evaluation

Table 3.2.2-9 - Suppression Pool System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bellows (Rx vessel to pool)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	V.F.EP-18	3.2.1-63	A
2	Bellows (Rx vessel to pool)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-26	3.2.1-40	A, 202
3	Bolting	Structural integrity	Stainless steel	Treated water (Ext)	Loss of material	Bolting Integrity	V.D2.EP-73	3.2.1-17	E
4	Bolting	Structural integrity	Stainless steel	Treated water (Ext)	Loss of preload	Bolting Integrity	V.E.EP-122	3.2.1-15	A
5	Strainer	Filtration	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B
6	Strainer	Filtration	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-73	3.2.1-17	B

Notes for Table 3.2.2-1 through Table 3.2.2-9

Standard Notes

A Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.
B Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.
D Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F Material not in NUREG-1801 for this component.
G Environment not in NUREG-1801 for this component and material.
H Aging effect not in NUREG-1801 for this component, material, and environment combination.
I Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J Neither the component nor the material and environment combination are evaluated in NUREG-1801.

Plant-Specific Notes

201 The internal environment of these components is Novec™ 7100, a fluorinated hydrocarbon used as a refrigerant. For the purposes of aging evaluation, this environment is compared to the GALL environment of "Lubricating oil."
202 The refueling bellows does not have an internal environment: Both sides are normally exposed to Air-indoor, uncontrolled. The upper surface is exposed to treated water only during refuelings and is accessible when drained down. External Surfaces Monitoring inspection of the upper surface of steel components is expected to provide leading indication of degradation.
203 Condensation environment is considered to be equivalent to Air - outdoor (external) for comparison of management of Loss of preload.
204 Per definitions in NUREG-1801, Section IX, Condensation is considered Raw Water.

Plant-Specific Notes (Continued)

205 External surface of elastomers in ventilation system duct and flexible connections is the same as the internal environment. So, monitoring the external surfaces will be indicative of internal surface. In addition to the Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components", additional testing, inspections, and reporting to be performed per Commitment L01090.

3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

3.3.1 INTRODUCTION

This section provides the results of the aging management review for those components identified in Section 2.3.3, Auxiliary Systems, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section are described in the indicated sections.

- Auxiliary Building Ventilation (Section 2.3.3.1)
- Breathable Air (Section 2.3.3.2)
- Building Heating (Section 2.3.3.3)
- Combustible Gas Control (Section 2.3.3.4)
- Computer Room HVAC (Section 2.3.3.5)
- Containment and Drywell Vacuum Relief (Section 2.3.3.6)
- Containment Integrated Leak Rate Test (Section 2.3.3.7)
- Containment Vessel and Drywell Purge (Section 2.3.3.8)
- Containment Vessel Chilled Water (Section 2.3.3.9)
- Control and Computer Room Humidification (Section 2.3.3.10)
- Control Complex Chilled Water (Section 2.3.3.11)
- Control Rod Drive (Section 2.3.3.12)
- Control Room HVAC and Emergency Recirculation (Section 2.3.3.13)
- Controlled Access and Miscellaneous Equipment Areas HVAC (Section 2.3.3.14)
- Diesel Generator and Auxiliaries (Section 2.3.3.15)
- Diesel Generator Building Ventilation (Section 2.3.3.16)
- ECCS Pump Room Cooling (Section 2.3.3.17)
- Emergency Closed Cooling (Section 2.3.3.18)
- Emergency Closed Cooling Pump Area HVAC (Section 2.3.3.19)
- Emergency Service Water (Section 2.3.3.20)
- Emergency Service Water Pump House Ventilation (Section 2.3.3.21)
- Emergency Service Water Screen Wash (Section 2.3.3.22)
- Feedwater Zinc Injection (Section 2.3.3.23)
- Fire Protection (Section 2.3.3.24)

- Floor and Equipment Drains (Section 2.3.3.25)
- Fuel Handling Area Ventilation (Section 2.3.3.26)
- Fuel Storage and Fuel Pool Cooling and Cleanup (Section 2.3.3.27)
- Hydrogen Water Chemistry (Section 2.3.3.28)
- Inclined Fuel Transfer System (Section 2.3.3.29)
- Industrial Waste Disposal (Section 2.3.3.30)
- Intermediate Building Ventilation (Section 2.3.3.31)
- Leak Detection (Section 2.3.3.32)
- Liquid Radwaste Disposal (Section 2.3.3.33)
- Liquid Radwaste Sumps (Section 2.3.3.34)
- MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust (Section 2.3.3.35)
- Miscellaneous Area Ventilation (Section 2.3.3.36)
- Miscellaneous Electrical Areas Smoke Ventilation (Section 2.3.3.37)
- Miscellaneous Sump (Section 2.3.3.38)
- Nitrogen Supply (Section 2.3.3.39)
- Nuclear Closed Cooling (Section 2.3.3.40)
- Offgas Building Ventilation (Section 2.3.3.41)
- Penetration Electrical (Section 2.3.3.42)
- Penetration Pressurization (Section 2.3.3.43)
- Plant Foundation Underdrain (Section 2.3.3.44)
- Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring (Section 2.3.3.45)
- Post Accident Sampling (Section 2.3.3.46)
- Potable Water Supply (Section 2.3.3.47)
- Rx Plant Sampling (Section 2.3.3.48)
- Radwaste Building Ventilation (Section 2.3.3.49)
- Reactor Vessel Servicing Equipment (Section 2.3.3.50)
- Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer (Section 2.3.3.51)
- Safety Related Instrument Air (Section 2.3.3.52)
- Sanitary Drains and Sewer (Section 2.3.3.53)
- Service Air and Instrument Air (Section 2.3.3.54)

- Service Water (Section 2.3.3.55)
- Standby Liquid Control (Section 2.3.3.56)
- Steam Tunnel Cooling (Section 2.3.3.57)
- Storm Drain and Sewer (Section 2.3.3.58)
- Suppression Pool Drain and Clean Up (Section 2.3.3.59)
- Suppression Pool Makeup (Section 2.3.3.60)
- Turbine Building Chilled Water (Section 2.3.3.61)
- Turbine Building Closed Cooling (Section 2.3.3.62)
- Turbine Building Ventilation (Section 2.3.3.63)

Table 3.3.1, Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of NUREG-1801 provides the summary of the programs evaluated in NUREG-1801 for the auxiliary systems component group. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.3.2 RESULTS

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for the Auxiliary Systems.

- Table 3.3.2-1 Auxiliary Building Ventilation
- Table 3.3.2-2 Breathable Air
- Table 3.3.2-3 Building Heating
- Table 3.3.2-4 Combustible Gas Control
- Table 3.3.2-5 Computer Room HVAC
- Table 3.3.2-6 Containment and Drywell Vacuum Relief
- Table 3.3.2-7 Containment Integrated Leak Rate Test
- Table 3.3.2-8 Containment Vessel and Drywell Purge
- Table 3.3.2-9 Containment Vessel Chilled Water
- Table 3.3.2-10 Control and Computer Room Humidification
- Table 3.3.2-11 Control Complex Chilled Water
- Table 3.3.2-12 Control Rod Drive
- Table 3.3.2-13 Control Room HVAC and Emergency Recirculation
- Table 3.3.2-14 Controlled Access and Miscellaneous Equipment Areas HVAC
- Table 3.3.2-15 Diesel Generator and Auxiliaries
- Table 3.3.2-16 Diesel Generator Building Ventilation

- Table 3.3.2-17 ECCS Pump Room Cooling
- Table 3.3.2-18 Emergency Closed Cooling
- Table 3.3.2-19 Emergency Closed Cooling Pump Area HVAC
- Table 3.3.2-20 Emergency Service Water
- Table 3.3.2-21 Emergency Service Water Pump House Ventilation
- Table 3.3.2-22 Emergency Service Water Screen Wash
- Table 3.3.2-23 Feedwater Zinc Injection
- Table 3.3.2-24 Fire Protection
- Table 3.3.2-25 Floor and Equipment Drains
- Table 3.3.2-26 Fuel Handling Area Ventilation
- Table 3.3.2-27 Fuel Storage and Fuel Pool Cooling and Cleanup
- Table 3.3.2-28 Hydrogen Water Chemistry
- Table 3.3.2-29 Inclined Fuel Transfer System
- Table 3.3.2-30 Industrial Waste Disposal
- Table 3.3.2-31 Intermediate Building Ventilation
- Table 3.3.2-32 Leak Detection
- Table 3.3.2-33 Liquid Radwaste Disposal
- Table 3.3.2-34 Liquid Radwaste Sumps
- Table 3.3.2-35 MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust
- Table 3.3.2-36 Miscellaneous Area Ventilation
- Table 3.3.2-37 Miscellaneous Electrical Areas Smoke Ventilation
- Table 3.3.2-38 Miscellaneous Sump
- Table 3.3.2-39 Nitrogen Supply
- Table 3.3.2-40 Nuclear Closed Cooling
- Table 3.3.2-41 Offgas Building Ventilation
- Table 3.3.2-42 Penetration Electrical
- Table 3.3.2-43 Penetration Pressurization
- Table 3.3.2-44 Plant Foundation Underdrain
- Table 3.3.2-45 Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring
- Table 3.3.2-46 Post Accident Sampling
- Table 3.3.2-47 Potable Water Supply

- Table 3.3.2-48 Rx Plant Sampling
- Table 3.3.2-49 Radwaste Building Ventilation
- Table 3.3.2-50 Reactor Vessel Servicing Equipment
- Table 3.3.2-51 Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer
- Table 3.3.2-52 Safety Related Instrument Air
- Table 3.3.2-53 Sanitary Drains and Sewer
- Table 3.3.2-54 Service Air and Instrument Air
- Table 3.3.2-55 Service Water
- Table 3.3.2-56 Standby Liquid Control
- Table 3.3.2-57 Steam Tunnel Cooling
- Table 3.3.2-58 Storm Drain and Sewer
- Table 3.3.2-59 Suppression Pool Drain and Clean Up
- Table 3.3.2-60 Suppression Pool Makeup
- Table 3.3.2-61 Turbine Building Chilled Water
- Table 3.3.2-62 Turbine Building Closed Cooling
- Table 3.3.2-63 Turbine Building Ventilation

Note that Table 3.3.2-42 Penetration Electrical, Table 3.3.2-50 Reactor Vessel Servicing Equipment, and Table 3.3.2-58 Storm Drain and Sewer systems do not have any mechanical components subject to aging management review and the corresponding AMR results tables contain no components.

3.3.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the auxiliary systems components subject to aging management review. Aging management programs are described in Appendix B. Further details are provided in the system tables.

3.3.2.1.1 Auxiliary Building Ventilation

Materials

Auxiliary Building Ventilation system components are constructed of the following materials:

- Copper alloy <15% Zn
- Steel

Environments

Auxiliary Building Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Raw water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Auxiliary Building Ventilation system components require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Auxiliary Building Ventilation system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.2 Breathable Air

Materials

Breathable Air system components are constructed of the following materials:

- Copper alloy >15% Zn
- Stainless steel
- Steel

Environments

Breathable Air system components are exposed to the following environments:

- Air – dry
- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Breathable Air system components require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on Breathable Air system components:

- External Surfaces Monitoring of Mechanical Components (B.2.18)

3.3.2.1.3 Building Heating

Materials

Building Heating system components are constructed of the following materials:

- Copper alloy <15% Zn
- Stainless steel
- Steel

Environments

Building Heating system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Closed-cycle cooling water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the Building Heating system components require management:

- Cracking
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Building Heating system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)

- External Surfaces Monitoring of Mechanical Components (B.2.18)

3.3.2.1.4 Combustible Gas Control

Materials

Combustible Gas Control system components are constructed of the following materials:

- CASS
- Copper alloy <15% Zn
- Glass
- Gray cast iron
- Stainless steel
- Steel

Environments

Combustible Gas Control system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Gas
- Lubricating oil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Combustible Gas Control system components require management:

- Loss of material
- Loss of preload
- Reduction of heat transfer

Aging Management Programs

The following aging management programs manage the effects of aging on Combustible Gas Control system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.3.2.1.5 Computer Room HVAC

Materials

Computer Room HVAC components are constructed of the following materials:

- Steel

Environments

Computer Room HVAC components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Computer Room HVAC system require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on Computer Room HVAC system components:

- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.6 Containment and Drywell Vacuum Relief

Materials

Containment and Drywell Vacuum Relief system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Containment and Drywell Vacuum Relief system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor

Aging Effects Requiring Management

The following aging effects associated with the Containment and Drywell Vacuum Relief system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Containment and Drywell Vacuum Relief system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.7 Containment Integrated Leak Rate Test

Materials

Containment Integrated Leak Rate Test system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Containment Integrated Leak Rate Test system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Containment Integrated Leak Rate Test system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Containment Integrated Leak Rate Test components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.8 Containment Vessel and Drywell Purge

Materials

Containment Vessel and Drywell Purge system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Containment Vessel and Drywell Purge system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Containment Vessel and Drywell Purge system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Containment Vessel and Drywell Purge components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- One-Time Inspection (B.2.35)

- Water Chemistry (B.2.44)

3.3.2.1.9 Containment Vessel Chilled Water

Materials

Containment Vessel Chilled Water system components are constructed of the following materials:

- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Gray cast iron
- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Containment Vessel Chilled Water system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Condensation
- Lubricating oil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Containment Vessel Chilled Water system require management:

- Cracking
- Loss of coating or lining integrity
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Containment Vessel Chilled Water system components:

- Bolting Integrity (B.2.7)

- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- Water Chemistry (B.2.44)

3.3.2.1.10 Control and Computer Room Humidification

Materials

Control and Computer Room Humidification system components are constructed of the following materials:

- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Stainless steel
- Steel

Environments

Control and Computer Room Humidification system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Condensation
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Control and Computer Room Humidification system require management:

- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Control and Computer Room Humidification system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- TLAA
- Water Chemistry (B.2.44)

3.3.2.1.11 Control Complex Chilled Water

Materials

Control Complex Chilled Water system components are constructed of the following materials:

- CASS
- Copper alloy <15% Zn
- Copper alloy >15% Zn, Solder Coated
- Copper alloy >15% Zn
- Glass
- Gray cast iron
- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Control Complex Chilled Water system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Condensation
- Gas
- Lubricating oil

- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Control Complex Chilled Water components require management:

- Cracking
- Loss of coating or lining integrity
- Loss of material
- Loss of preload
- Reduction of heat transfer

Aging Management Programs

The following aging management programs manage the effects of aging on Control Complex Chilled Water components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.3.2.1.12 Control Rod Drive

Materials

Control Rod Drive system components are constructed of the following materials:

- CASS
- Copper alloy >15% Zn
- Glass
- Gray cast iron
- Stainless steel
- Steel

Environments

Control Rod Drive system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Gas
- Lubricating oil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Control Rod Drive components require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Control Rod Drive components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- TLAA
- Water Chemistry (B.2.44)

3.3.2.1.13 Control Room HVAC and Emergency Recirculation

Materials

Control Room HVAC and Emergency Recirculation system components are constructed of the following materials:

- Aluminum

- Copper alloy <15% Zn
- Elastomers
- Stainless Steel
- Steel

Environments

Control Room HVAC and Emergency Recirculation system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Condensation
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Control Room HVAC and Emergency Recirculation components require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Control Room HVAC and Emergency Recirculation components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.14 Controlled Access and Miscellaneous Equipment Areas HVAC

Materials

Controlled Access and Miscellaneous Equipment Areas HVAC system components are constructed of the following materials:

- Steel

Environments

Controlled Access and Miscellaneous Equipment Areas HVAC system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Controlled Access and Miscellaneous Equipment Areas HVAC system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Controlled Access and Miscellaneous Equipment Areas HVAC system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.15 Diesel Generator and Auxiliaries

3.3.2.1.15.1 Starting Air and Control Air

Materials

Starting Air and Control Air system components are constructed of the following materials:

- Aluminum
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Stainless steel
- Steel
- Zinc

Environments

Starting Air and Control Air system components are exposed to the following environments:

- Air – dry
- Air – indoor, uncontrolled
- Condensation
- Lubricating oil

Aging Effects Requiring Management

The following aging effects associated with the Starting Air and Control Air system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Starting Air and Control Air system components:

- Bolting Integrity (B.2.7)
- Compressed Air Monitoring (B.2.16)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)

3.3.2.1.15.2 Fuel Oil

Materials

Fuel Oil system components are constructed of the following materials:

- Aluminum
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Gray cast iron
- Stainless steel
- Steel

- Steel with internal coating/lining

Environments

Fuel Oil system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Fuel oil
- Soil

Aging Effects Requiring Management

The following aging effects associated with the Fuel Oil system require management:

- Loss of coating or lining integrity
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Fuel Oil system components:

- Bolting Integrity (B.2.7)
- Buried and Underground Piping and Tanks (B.2.8)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Fuel Oil Chemistry (B.2.23)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- One-Time Inspection (B.2.35)

3.3.2.1.15.3 Cooling Water

Materials

Cooling Water system components are constructed of the following materials:

- Aluminum
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass

- Gray cast iron
- Stainless steel
- Steel

Environments

Cooling Water system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Lubricating oil
- Raw water

Aging Effects Requiring Management

The following aging effects associated with the Cooling Water system require management:

- Loss of material
- Loss of preload
- Reduction of heat transfer

Aging Management Programs

The following aging management programs manage the effects of aging on Cooling Water system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Open-Cycle Cooling Water System (B.2.37)
- Selective Leaching (B.2.42)

3.3.2.1.15.4 Lubricating Oil

Materials

Lubricating Oil system components are constructed of the following materials:

- Aluminum

- Copper alloy >15% Zn
- Glass
- Gray cast iron
- Stainless steel
- Steel

Environments

Lubricating Oil system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Lubricating oil

Aging Effects Requiring Management

The following aging effects associated with the Lubricating Oil system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Lubricating Oil system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)

3.3.2.1.15.5 Air Intake and Exhaust

Materials

Air Intake and Exhaust system components are constructed of the following materials:

- Aluminum
- Stainless steel
- Steel

Environments

Air Intake and Exhaust system components are exposed to the following environments:

- Air – indoor, uncontrolled

- Air – outdoor
- Closed-cycle cooling water
- Diesel exhaust
- Lubricating oil

Aging Effects Requiring Management

The following aging effects associated with the Air Intake and Exhaust system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Air Intake and Exhaust system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- TLAA

3.3.2.1.16 Diesel Generator Building Ventilation

Materials

Diesel Generator Building Ventilation system components are constructed of the following materials:

- Elastomers
- Steel

Environments

Diesel Generator Building Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor

Aging Effects Requiring Management

The following aging effects associated with the Diesel Generator Building Ventilation system require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Diesel Generator Building Ventilation system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.17 ECCS Pump Room Cooling

Materials

ECCS Pump Room Cooling system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

ECCS Pump Room Cooling system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the ECCS Pump Room Cooling system require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on ECCS Pump Room Cooling system components:

- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.18 Emergency Closed Cooling

Materials

Emergency Closed Cooling system components are constructed of the following materials:

- Copper alloy <15% Zn
- Glass
- Stainless steel
- Steel
- Steel with stainless steel cladding

Environments

Emergency Closed Cooling system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Emergency Closed Cooling system require management:

- Loss of material
- Loss of preload
- Reduction of heat transfer

Aging Management Programs

The following aging management programs manage the effects of aging on Emergency Closed Cooling system components:

- Bolting Integrity (B.2.7)

- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- One-Time Inspection (B.2.35)
- Open-Cycle Cooling Water System (B.2.37)
- Water Chemistry (B.2.44)

3.3.2.1.19 Emergency Closed Cooling Pump Area HVAC

Materials

Emergency Closed Cooling Pump Area HVAC system components are constructed of the following materials:

- Elastomers
- Steel

Environments

Emergency Closed Cooling Pump Area HVAC system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Emergency Closed Cooling Pump Area HVAC system require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Emergency Closed Cooling Pump Area HVAC system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.20 Emergency Service Water

Materials

Emergency Service Water system components are constructed of the following materials:

- CASS
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Stainless steel
- Steel

Environments

Emergency Service Water system components are exposed to the following environments:

- Air – dry
- Air – indoor, uncontrolled
- Condensation
- Lubricating oil
- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects associated with the Emergency Service Water system require management:

- Cracking
- Loss of material
- Loss of preload
- Reduction of heat transfer

Aging Management Programs

The following aging management programs manage the effects of aging on Emergency Service Water system components:

- Bolting Integrity (B.2.7)
- Buried and Underground Piping and Tanks (B.2.8)
- External Surfaces Monitoring of Mechanical Components (B.2.18)

- Flow-Accelerated Corrosion (B.2.22)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Open-Cycle Cooling Water System (B.2.37)
- Selective Leaching (B.2.42)

3.3.2.1.21 Emergency Service Water Pump House Ventilation

Materials

Emergency Service Water Pump House Ventilation system components are constructed of the following materials:

- Steel

Environments

Emergency Service Water Pump House Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Emergency Service Water Pump House Ventilation system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Emergency Service Water Pump House Ventilation system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.22 Emergency Service Water Screen Wash

Materials

Emergency Service Water Screen Wash system components are constructed of the following materials:

- Gray cast iron
- Stainless steel
- Steel

Environments

Emergency Service Water Screen Wash system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Lubricating oil
- Raw water

Aging Effects Requiring Management

The following aging effects associated with the Emergency Service Water Screen Wash system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Emergency Service Water Screen Wash system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Open-Cycle Cooling Water System (B.2.37)
- Selective Leaching (B.2.42)

3.3.2.1.23 Feedwater Zinc Injection

Materials

Feedwater Zinc Injection system components are constructed of the following materials:

- Stainless steel

Environments

Feedwater Zinc Injection system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Feedwater Zinc Injection system require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on Feedwater Zinc Injection system components:

- Closed Treated Water Systems (B.2.15)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.3.2.1.24 Fire Protection

Materials

Fire Protection system components are constructed of the following materials:

- Aluminum
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Fiberglass
- Glass
- Gray cast iron
- Gray cast iron with internal coating/lining
- Polymers
- Stainless steel
- Steel

Environments

Fire Protection system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Closed-cycle cooling water
- Condensation
- Diesel exhaust
- Fuel oil
- Gas
- Lubricating oil
- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects associated with the Fire Protection system require management:

- Change in mechanical properties, Blistering
- Cracking
- Cumulative fatigue damage
- Flow blockage
- Loss of coating or lining integrity
- Loss of material
- Loss of preload
- Reduction of heat transfer

Aging Management Programs

The following aging management programs manage the effects of aging on Fire Protection system components:

- Bolting Integrity (B.2.7)
- Buried and Underground Piping and Tanks (B.2.8)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Fire Protection (B.2.20)
- Fire Water System (B.2.21)
- Fuel Oil Chemistry (B.2.23)

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- TLAA

3.3.2.1.25 Floor and Equipment Drains

Materials

Floor and Equipment Drains system components are constructed of the following materials:

- Copper alloy <15% Zn
- Gray cast iron
- Stainless steel
- Steel

Environments

Floor and Equipment Drains system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Concrete
- Soil
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Floor and Equipment Drains system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Floor and Equipment Drains system components:

- Bolting Integrity (B.2.7)

- Buried and Underground Piping and Tanks (B.2.8)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Selective Leaching (B.2.42)

3.3.2.1.26 Fuel Handling Area Ventilation

Materials

Fuel Handling Area Ventilation system components are constructed of the following materials:

- Aluminum
- Copper alloy <15% Zn
- Elastomers
- Stainless steel
- Steel

Environments

Fuel Handling Area Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Fuel Handling Area Ventilation system require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Fuel Handling Area Ventilation system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.27 Fuel Storage and Fuel Pool Cooling and Cleanup

Materials

Fuel Storage and Fuel Pool Cooling and Cleanup system components are constructed of the following materials:

- Aluminum
- Boral
- CASS
- Glass
- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Fuel Storage and Fuel Pool Cooling and Cleanup system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Concrete
- Treated water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Fuel Storage and Fuel Pool Cooling and Cleanup system require management:

- Change in dimension
- Loss of coating or lining integrity
- Loss of material
- Loss of preload
- Reduction of heat transfer
- Reduction of neutron absorption

Aging Management Programs

The following aging management programs manage the effects of aging on Fuel Storage and Fuel Pool Cooling and Cleanup system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- Monitoring of Neutron-Absorbing Materials Other Than Boraflex (B.2.30)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.3.2.1.28 Hydrogen Water Chemistry

Materials

The Hydrogen Water Chemistry system components are constructed of the following materials:

- Stainless steel

Environments

The Hydrogen Water Chemistry system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water >60˚C (>140˚F)

Aging Effects Requiring Management

The following aging effects associated with the Hydrogen Water Chemistry system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on the Hydrogen Water Chemistry system components:

- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.3.2.1.29 Inclined Fuel Transfer Equipment

Materials

Inclined Fuel Transfer Equipment system components are constructed of the following materials:

- CASS
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Stainless steel
- Steel

Environments

Inclined Fuel Transfer Equipment system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Inclined Fuel Transfer Equipment system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Inclined Fuel Transfer Equipment system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- Water Chemistry (B.2.44)

3.3.2.1.30 Industrial Waste Disposal

Materials

Industrial Waste Disposal system components are constructed of the following materials:

- Steel

Environments

Industrial Waste Disposal system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Concrete
- Soil
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Industrial Waste Disposal system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Industrial Waste Disposal system components:

- Bolting Integrity (B.2.7)
- Buried and Underground Piping and Tanks (B.2.8)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.31 Intermediate Building Ventilation

Materials

Intermediate Building Ventilation system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Intermediate Building Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Intermediate Building Ventilation system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Intermediate Building Ventilation system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.32 Leak Detection

Materials

Leak Detection system components are constructed of the following materials:

- Glass
- Stainless steel
- Steel

Environments

Leak Detection system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Condensation
- Treated water
- Treated water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the Leak Detection system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Leak Detection system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.3.2.1.33 Liquid Radwaste Disposal

Materials

Liquid Radwaste Disposal system components are constructed of the following materials:

- CASS
- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Liquid Radwaste Disposal system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Concrete
- Treated water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Liquid Radwaste Disposal system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Liquid Radwaste Disposal system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.3.2.1.34 Liquid Radwaste Sumps

Materials

Liquid Radwaste Sumps system components are constructed of the following materials:

- Gray cast iron
- Stainless steel
- Steel

Environments

Liquid Radwaste Sumps system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Liquid Radwaste Sumps system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Liquid Radwaste Sumps system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Selective Leaching (B.2.42)

3.3.2.1.35 MCC Switchgear and Miscellaneous Electrical Area HVAC and Battery Room Exhaust

Materials

MCC Switchgear and Miscellaneous Electrical Area HVAC and Battery Room Exhaust systems components are constructed of the following materials:

- Aluminum
- Elastomers
- Steel

Environments

MCC Switchgear and Miscellaneous Electrical Area HVAC and Battery Room Exhaust systems components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the MCC Switchgear and Miscellaneous Electrical Area HVAC and Battery Room Exhaust systems require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on MCC Switchgear and Miscellaneous Electrical Area HVAC and Battery Room Exhaust systems components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.36 Miscellaneous Area Ventilation

Materials

Miscellaneous Area Ventilation system components are constructed of the following materials:

- Elastomers
- Steel

Environments

Miscellaneous Area Ventilation c system omponents are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Miscellaneous Area Ventilation system require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Miscellaneous Area Ventilation system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.37 Miscellaneous Electrical Areas Smoke Ventilation

Materials

Miscellaneous Electrical Areas Smoke Ventilation system components are constructed of the following materials:

- Elastomers
- Steel

Environments

Miscellaneous Electrical Areas Smoke Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Miscellaneous Electrical Areas Smoke Ventilation system require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Miscellaneous Electrical Areas Smoke Ventilation system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.38 Miscellaneous Sump

Materials

Miscellaneous Sump system components are constructed of the following materials:

- Steel

Environments

Miscellaneous Sump system components are exposed to the following environments:

- Air – outdoor
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Miscellaneous Sump system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Miscellaneous Sump system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.39 Nitrogen Supply

Materials

Nitrogen Supply system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Nitrogen Supply system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Gas

Aging Effects Requiring Management

The following aging effects associated with the Nitrogen Supply system require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on Nitrogen Supply system components:

- External Surfaces Monitoring of Mechanical Components (B.2.18)

3.3.2.1.40 Nuclear Closed Cooling

Materials

Nuclear Closed Cooling system components are constructed of the following materials:

- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Gray cast iron
- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Nuclear Closed Cooling system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Lubricating oil
- Raw water

Aging Effects Requiring Management

The following aging effects associated with the Nuclear Closed Cooling system require management:

- Loss of coating or lining integrity
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Nuclear Closed Cooling system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)

3.3.2.1.41 Offgas Building Ventilation

Materials

Offgas Building Ventilation system components are constructed of the following materials:

- Elastomers
- Steel

Environments

Offgas Building Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Offgas Building Ventilation system require management:

- Hardening and loss of strength
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Offgas Building Ventilation system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.42 Penetration Electrical

There are no mechanical components in the Electrical Penetration system subject to aging management review. The penetration components that support containment pressure boundary integrity are evaluated as structural components.

Materials

Penetration Electrical system components are constructed of the following materials:

- N/A

Environments

Penetration Electrical system components are exposed to the following environments:

- N/A

Aging Effects Requiring Management

The following aging effects associated with the Penetration Electrical system require management:

- None

Aging Management Programs

The following aging management programs manage the effects of aging on Penetration Electrical system components:

- None

3.3.2.1.43 Penetration Pressurization

Materials

Penetration Pressurization system components are constructed of the following materials:

- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Stainless steel
- Steel

Environments

Penetration Pressurization system components are exposed to the following environments:

- Air – dry
- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Penetration Pressurization system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Penetration Pressurization system components:

- Bolting Integrity (B.2.7)
- Compressed Air Monitoring (B.2.16)
- External Surfaces Monitoring of Mechanical Components (B.2.18)

3.3.2.1.44 Plant Foundation Underdrain

Materials

Plant Foundation Underdrain system components are constructed of the following materials:

- Steel

Environments

Plant Foundation Underdrain system components are exposed to the following environments:

- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects associated with the Plant Foundation Underdrain system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Plant Foundation Underdrain system components:

- Bolting Integrity (B.2.7)
- Buried and Underground Piping and Tanks (B.2.8)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.45 Plant Radiation Monitoring and Process Monitoring and Post-Accident Radiation Monitoring

Materials

Plant Radiation Monitoring and Process Monitoring and Post Accident Radiation Monitoring systems components are constructed of the following materials:

- Copper alloy <15% Zn
- Stainless steel
- Steel

Environments

Plant Radiation Monitoring and Process Monitoring and Post Accident Radiation Monitoring systems components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Raw water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Plant Radiation Monitoring and Process Monitoring and Post Accident Radiation Monitoring systems require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Plant Radiation Monitoring and Process Monitoring and Post Accident Radiation Monitoring systems components:

- Bolting Integrity (B.2.7)

- Closed Treated Water Systems (B.2.15)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Open-Cycle Cooling Water System (B.2.37)

3.3.2.1.46 Post Accident Sampling

Materials

Post Accident Sampling system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Post Accident Sampling system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Treated water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Post Accident Sampling system require management:

- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Post Accident Sampling system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- One-Time Inspection (B.2.35)
- TLAA

- Water Chemistry (B.2.44)

3.3.2.1.47 Potable Water Supply

Materials

Potable Water Supply system components are constructed of the following materials:

- Copper alloy <15% Zn
- Gray cast iron
- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Potable Water Supply system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Raw water

Aging Effects Requiring Management

The following aging effects associated with the Potable Water Supply system require management:

- Loss of coating or lining integrity
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Potable Water Supply system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- Selective Leaching (B.2.42)

3.3.2.1.48 Rx Plant Sampling

Materials

Rx Plant Sampling system components are constructed of the following materials:

- CASS
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Stainless steel
- Steel

Environments

Rx Plant Sampling system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Treated water
- Treated water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the Rx Plant Sampling system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Process Sampling Rx Plant Sampling system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- TLAA

- Water Chemistry (B.2.44)

3.3.2.1.49 Radwaste Building Ventilation

Materials

Radwaste Building Ventilation system components are constructed of the following materials:

- Steel

Environments

Radwaste Building Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Radwaste Building Ventilation system require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on Radwaste Building Ventilation system components:

- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.50 Reactor Vessel Servicing Equipment

Reactor Vessel Servicing Equipment have no mechanical system components subject to aging management.

Materials

Reactor Vessel Servicing Equipment components are constructed of the following materials:

- N/A

Environments

Reactor Vessel Servicing Equipment components are exposed to the following environments:

- N/A

Aging Effects Requiring Management

The following aging effects associated with the Reactor Vessel Servicing Equipment require management:

- N/A

Aging Management Programs

The following aging management programs manage the effects of aging on Reactor Vessel Servicing Equipment components:

- N/A

3.3.2.1.51 Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer

Materials

Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer systems components are constructed of the following materials:

- Copper alloy >15% Zn
- Glass
- Stainless steel
- Steel

Environments

Reactor Water Clean Up system and Reactor Water Clean Up Filter Demineralizer systems are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Treated water
- Treated water >60˚C (>140˚F)

Aging Effects Requiring Management

The following aging effects associated with the Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer systems require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer systems components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- TLAA
- Water Chemistry (B.2.44)

3.3.2.1.52 Safety Related Instrument Air

Materials

Safety Related Instrument Air system components are constructed of the following materials:

- Polymers
- Stainless steel
- Steel
- Steel with stainless steel cladding

Environments

Safety Related Instrument Air system components are exposed to the following environments:

- Air – dry
- Air – indoor, uncontrolled
- Condensation

Aging Effects Requiring Management

The following aging effects associated with the Safety Related Instrument Air system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Safety Related Instrument Air system components:

- Bolting Integrity (B.2.7)
- Compressed Air Monitoring (B.2.16)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.53 Sanitary Drains and Sewer

Materials

Sanitary Drains and Sewer system components are constructed of the following materials:

- Copper alloy >15% Zn
- Gray cast iron
- Steel

Environments

Sanitary Drains and Sewer system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Concrete
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Sanitary Drains and Sewer system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Sanitary Drains and Sewer system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Selective Leaching (B.2.42)

3.3.2.1.54 Service Air and Instrument Air

Materials

Service Air and Instrument Air system components are constructed of the following materials:

- Aluminum
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Stainless steel
- Steel

Environments

Service Air and Instrument Air system components are exposed to the following environments:

- Air – dry
- Air – indoor, uncontrolled
- Condensation
- Lubricating oil

Aging Effects Requiring Management

The following aging effects associated with the Service Air and Instrument Air system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Service Air and Instrument Air system components:

- Bolting Integrity (B.2.7)
- Compressed Air Monitoring (B.2.16)
- External Surfaces Monitoring of Mechanical Components (B.2.18)

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)

3.3.2.1.55 Service Water

Materials

Service Water system components are constructed of the following materials:

- CASS
- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Gray cast iron
- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Service Water system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Condensation
- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects associated with the Service Water system require management:

- Cracking
- Loss of coating or lining integrity
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Service Water system components:

- Bolting Integrity (B.2.7)

- Buried and Underground Piping and Tanks (B.2.8)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)

3.3.2.1.56 Standby Liquid Control

Materials

Standby Liquid Control system components are constructed of the following materials:

- CASS
- Stainless steel
- Steel

Environments

Standby Liquid Control system components are exposed to the following environments:

- Air – dry
- Air – indoor, uncontrolled
- Sodium pentaborate solution
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Standby Liquid Control system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Standby Liquid Control system components:

- Bolting Integrity (B.2.7)
- Compressed Air Monitoring (B.2.16)
- External Surfaces Monitoring of Mechanical Components (B.2.18)

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.3.2.1.57 Steam Tunnel Cooling

Materials

Steam Tunnel Cooling system components are constructed of the following materials:

- Steel

Environments

Steam Tunnel Cooling system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Steam Tunnel Cooling system require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on Steam Tunnel Cooling system components:

- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.1.58 Storm Drain and Sewer

The Storm Drain and Sewer system has no mechanical system components subject to aging management. Storm Drain and Sewer system components are evaluated under Civil / Structural as water control structures. Building roof drain components are evaluated with Floor and Equipment Drains system.

Materials

The Storm Drain and Sewer system components are constructed of the following materials:

- N/A

Environment

Storm Drain and Sewer system components are exposed to the following environments:

- N/A

Aging Effects Requiring Management

The following aging effects associated with the Storm Drain and Sewer system require management:

- N/A

Aging Management Programs

The following aging management programs manage the effects of aging on Storm Drain and Sewer system components:

- N/A

3.3.2.1.59 Suppression Pool Drain and Clean Up

Materials

Suppression Pool Drain and Clean Up system components are constructed of the following materials:

- CASS
- Stainless steel
- Steel

Environments

Suppression Pool Drain and Clean Up system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Suppression Pool Drain and Clean Up system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Suppression Pool Drain and Clean Up system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.3.2.1.60 Suppression Pool Makeup

Materials

Suppression Pool Makeup system components are constructed of the following materials:

- CASS
- Stainless steel
- Steel

Environments

Suppression Pool Makeup system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Suppression Pool Makeup system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Suppression Pool Makeup system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- One-Time Inspection (B.2.35)

- Water Chemistry (B.2.44)

3.3.2.1.61 Turbine Building Chilled Water

Materials

Turbine Building Chilled Water system components are constructed of the following materials:

- Copper alloy <15% Zn
- Copper alloy >15% Zn
- Glass
- Gray cast iron
- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Turbine Building Chilled Water system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water
- Condensation
- Lubricating oil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Turbine Building Chilled Water system require management:

- Cracking
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Turbine Building Chilled Water system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)

- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- Lubricating Oil Analysis (B.2.28)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- Water Chemistry (B.2.44)

3.3.2.1.62 Turbine Building Closed Cooling

Materials

Turbine Building Closed Cooling system components are constructed of the following materials:

- Gray cast iron
- Steel

Environments

Turbine Building Closed Cooling system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Closed-cycle cooling water

Aging Effects Requiring Management

The following aging effects associated with the Turbine Building Closed Cooling system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Turbine Building Closed Cooling system components:

- Bolting Integrity (B.2.7)
- Closed Treated Water Systems (B.2.15)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Selective Leaching (B.2.42)

3.3.2.1.63 Turbine Building Ventilation

Materials

Turbine Building Ventilation system components are constructed of the following materials:

- Steel

Environments

Turbine Building Ventilation system components are exposed to the following environments:

- Air – indoor, uncontrolled

Aging Effects Requiring Management

The following aging effects associated with the Turbine Building Ventilation system require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the effects of aging on Turbine Building Ventilation system components:

- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)

3.3.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.3.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the PNPP approach to those areas requiring further evaluation. Programs are described in Appendix B.

Note - Italicized text at the beginning of each Further Evaluation subsection is taken directly from NUREG-1800 as supplemented by LR-ISG-2011-05 and LR-ISG-2012-02.

3.3.2.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section

4.3, "Metal Fatigue Analysis," or Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," of this SRP-LR.

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of metal fatigue as a TLAA for non-Class 1 components in the Control and Computer Room Humidification, Control Rod Drive, Div.1&2 Standby Diesel Generator Exhaust, Intake and Crankcase, Hydrogen Water Chemistry, Leak Detection, Reactor Water Clean up, and Reactor Plant Sampling systems is discussed in Section 4.3.2 either specifically or as part of the global evaluation. Likewise, in addition, non-Class 1 components in the Emergency Safety Feature Systems (Residual Heat Removal and Containment Spray, High Pressure Core Spray, Low Pressure Core Spray, and Reactor Core Isolation Cooling systems) and Steam And Power Conversion Systems (Feedwater Control, Feedwater and Feedwater Leakage Control, and Main and Reheat Steam systems) is addressed in Section 4.3.2. See Section 4.3 for a complete evaluation of metal fatigue.

3.3.2.2.2 Cracking due to Stress Corrosion Cracking and Cyclic Loading

Cracking due to SCC and cyclic loading could occur in stainless steel PWR non-regenerative heat exchanger components exposed to treated borated water greater than 60°C (>140°F) in the chemical and volume control system. The existing aging management program on monitoring and control of primary water chemistry in PWRs manages the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL Report recommends that a plant-specific aging management program be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.

This paragraph in NUREG-1800 pertains to PWR non-regenerative heat exchanger components and is therefore not applicable to PNPP.

3.3.2.2.3 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements and tanks exposed to outdoor air. The possibility of cracking also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents. Cracking is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas *subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above.*

GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect. The applicant may demonstrate that this item is not applicable by describing the outdoor air environment present at the plant and demonstrating that external chloride stress corrosion cracking is not expected. The GALL Report recommends further evaluation to determine whether an adequate aging management program is used to manage this aging effect based on the environmental conditions applicable to the plant and ASME Code Section XI requirements applicable to the components.

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. There are no stainless steel piping, piping components, piping elements, and tanks subject to aging management review that are exposed to Air – outdoor in the Auxiliary systems. Therefore, this item is not used.

3.3.2.2.4 Loss of Material due to Cladding Breach

Loss of material due to cladding breach could occur for PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks," and recommends further evaluation of a plant-specific aging management program to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

This paragraph in NUREG-1800 pertains to PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. PNPP is a BWR, and does not have steel charging pump casings with stainless steel cladding exposed to treated borated water. Therefore, this item is not applicable to PNPP.

3.3.2.2.5 Loss of Material due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The possibility of pitting and crevice corrosion also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents. Pitting and crevice corrosion is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination *from other agricultural or industrial sources. This item is applicable for the environments described above.*

GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect. The applicant may demonstrate that this item is not applicable by describing the outdoor air environment present at the plant and demonstrating that external pitting or crevice corrosion is not expected. The GALL Report recommends further evaluation to determine whether an adequate aging management program is used to manage this aging effect based on the environmental conditions applicable to the plant and ASME Code Section XI requirements Quality Assurance for Aging Management of Nonsafety-Related Components.

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. There are no stainless steel piping, piping components, piping elements, and tanks subject to aging management review that are exposed to outdoor air in the Auxiliary systems. Therefore, this item is not used.

3.3.2.2.6 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2, of this SRP-LR.)

See Appendix B Section B.1.3 for discussion of PNPP quality assurance procedures and administrative controls for aging management programs.

3.3.2.2.7 Ongoing Review of Operating Experience (Per LR-ISG-2011-05)

Ongoing review of operating experience is addressed in Appendix A, Section A.1 and Appendix B, Section B.1.4.

3.3.2.2.8 Loss of Material due to Recurring Internal Corrosion

Recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL Report. During the search of plant-specific OE conducted during the LRA development, recurring internal corrosion can be identified by the number of occurrences of aging effects and the extent of degradation at each localized corrosion site. This further evaluation item is applicable if the search of plant-specific OE reveals repetitive occurrences (e.g., one per refueling outage cycle that has occurred over: (a) three or more sequential or nonsequential cycles for a 10-year OE search, or (b) two or more sequential or nonsequential cycles for a 5-year OE search) of aging effects with the same aging mechanism in which the aging effect resulted in the component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness.

The GALL Report recommends that a plant-specific AMP, or a new or existing AMP, be evaluated for inclusion of augmented requirements to ensure the adequate management of any recurring aging effect(s). Potential augmented requirements include: alternative examination methods (e.g., volumetric versus external visual), augmented inspections (e.g., a greater number of locations, additional locations based on risk insights based on susceptibility to aging effect and consequences of failure, a greater frequency of inspections), and additional trending parameters and decision points where increased inspections would be implemented. Acceptance criteria are described in Appendix A.1, "Aging Management Review – Generic (Branch Technical Position RSLB-1)."

The applicant states: (a) why the program's examination methods will be sufficient to detect the recurring aging effect before affecting the ability of a component to perform its intended function, (b) the basis for the adequacy of augmented or lack of augmented inspections, (c) what parameters will be trended as well as the decision points where increased inspections would be implemented (e.g., the extent of degradation at individual corrosion sites, the rate of degradation change), (d) how inspections of components that are not easily accessed (i.e., buried, underground) will be conducted, and (e) how leaks in any involved buried or underground components will be identified.

Each plant-specific operating experience example should be evaluated to determine if the chosen AMP should be augmented even if the thresholds for significance of aging effect or frequency of occurrence of aging effect have not been exceeded. For example, during a 10-year search of plant specific operating experience, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the operating experience should be evaluated to determine if the AMP that is proposed to manage the aging effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the CLB intended functions of the component will be met throughout the period of extended operation. Likewise, the GALL Report AMR items associated with the new FE items only cite raw water and waste water environments because OE indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific OE reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.

LR-ISG-2012-02 has been issued which addresses instances of recurring internal corrosion identified during review of plant-specific operating experience. The operating experience for PNPP has been reviewed and instances of internal corrosion in the Emergency Service Water and Fire Water Systems has been identified with a frequency that is consistent with the thresholds discussed in LR-ISG-2012-02.

As provided in the Open-Cycle Cooling Water Program (LRA Section B.2.37), loss of material due to recurring internal corrosion and erosion for the Emergency Service Water System is managed by augmented inspections utilizing the Flow Accelerated Corrosion

Program (LRA Section B.2.22). These inspections consist of volumetric wall thickness examinations. Locations that have experienced loss of material are monitored for wall thickness and a loss rate is determined. The next inspection or component repair/replacement occurs prior to exceeding minimum wall acceptance criteria.

As provided in the Fire Water System Program (LRA Section B.2.21), loss of material due to recurring internal corrosion for the Fire Water System is managed by augmented inspections. The program will be enhanced to require that when visual inspections are used to detect loss of material, the inspection technique is capable of detecting surface irregularities that could indicate wall loss to below nominal pipe wall thickness due to corrosion and corrosion product deposition. Where such irregularities are detected, follow-up volumetric wall thickness examinations will be performed. For the buried piping, visual inspections of the piping interior surfaces will be performed whenever the piping internal surface is made accessible due to maintenance and repair activities. In addition, a portion of the aboveground inspection locations will be selected with process conditions similar to those in the buried piping to use as an indicator of the condition of the buried piping.

3.3.2.3 Time-Limited Aging Analysis

The time-limited aging analyses identified associated with Auxiliary System components and Structural components (e.g., Cranes) are addressed in Section 4. Table 4.1-2 provides TLAA results and identifies whether the TLAA remains valid for the PEO, will be managed during the PEO, and the LRA sections that address them.

3.3.3 Conclusion

The Auxiliary Systems piping, fittings, and components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage aging effects for the Auxiliary Systems components are identified in the summaries in Section 3.3.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Auxiliary Systems components will be adequately managed so that there is reasonable assurance that the intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-1	Steel Cranes: structural girders exposed to Air – indoor, uncontrolled (External)	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54 (Standard Review Plan, Section 4.7, "Other Plant- Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1))	Yes, TLAA (See subsection 3.3.2.2.1)	Consistent with NUREG-1801. This item is not used by Auxiliary systems. Steel cranes in the Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures, Containment Structure and Water Control Structures are evaluated as structural components and are aligned with this item. Cumulative fatigue damage is a TLAA. Also, see further evaluation section 3.3.2.2.1.
3.3.1-2	Stainless steel, Steel Heat exchanger components and tubes, Piping, piping components, and piping elements exposed to Treated borated water, Air - indoor, uncontrolled, Treated water	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA (See subsection 3.3.2.2.1)	Consistent with NUREG-1801. Cumulative fatigue damage is a TLAA. See further evaluation section 3.3.2.2.1. In addition to Auxiliary Systems components, TLAA will also manage fatigue of Feedwater, Main Steam, Residual Heat Removal, High Pressure Core Spray, Low Pressure Core Spray and Reactor Core Isolation Cooling components.
3.3.1-3	PWR only				

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-4	Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated (See subsection 3.3.2.2.3)	Not applicable. There are no Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor in the Auxiliary systems. See further evaluation section 3.3.2.2.3.
3.3.1-5	PWR only				
3.3.1-6	Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated (See subsection 3.3.2.2.5)	Not applicable. There are no Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor in the Auxiliary systems. See further evaluation 3.3.2.2.5.
3.3.1-7	PWR only				
3.3.1-8	PWR only				
3.3.1-9	PWR only				
3.3.1-10	Steel, high-strength Closure bolting exposed to Air with steam or water leakage	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M18, "Bolting Integrity"	No	Not applicable. There is no steel, high strength closure bolting subject to aging management review in the Auxiliary systems that is exposed to air with steam or water leakage.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-11	Steel, high-strength High-pressure pump, closure bolting exposed to Air with steam or water leakage	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M18, "Bolting Integrity"	No	Not applicable. There is no steel, high strength, high pressure pump closure bolting subject to aging management review in the Auxiliary systems that is exposed to air with steam or water leakage.
3.3.1-12	Steel; stainless steel Closure bolting, Bolting exposed to Condensation, Air – indoor, uncontrolled (External), Air – outdoor (External)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity program will manage loss of material for steel bolting exposed to air - indoor, uncontrolled, air - outdoor, and condensation. In addition to bolting in the Auxiliary systems, the Bolting Integrity program will manage loss of material for steel bolting in the Offgas system exposed to condensation.
3.3.1-13	Steel Closure bolting exposed to Air with steam or water leakage	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	Not applicable. There is no steel closure bolting subject to aging management review in the Auxiliary systems that is exposed to air with steam or water leakage.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-14	Steel, Stainless Steel Bolting exposed to Soil	Loss of preload	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity program will manage loss of preload for steel bolting exposed to soil. There is no stainless steel bolting subject to aging management review in the Auxiliary systems that is exposed to soil.
3.3.1-15	Steel; stainless steel, Copper alloy, Nickel alloy, Stainless steel Closure bolting, Bolting exposed to Air – indoor, uncontrolled (External), Any environment, Air – outdoor (External), Raw water, Treated borated water, Fuel oil, Treated water	Loss of preload due to thermal effects, gasket creep, and self- loosening	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity program will manage loss of preload of stainless steel bolting in air - indoor uncontrolled and treated water and steel bolting in Air - indoor uncontrolled, Air-outdoor, Condensation, and Raw water. Additionally, for the purpose of aging management comparison of loss of preload for steel bolting, the condensation environment is considered equivalent to Air - outdoor. There is no copper alloy or nickel alloy bolting subject to aging management review in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-16	Stainless steel Piping, piping components, and piping elements exposed to Treated water >60˚C (>140˚F)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M25, "BWR Reactor Water Cleanup System"	No	Consistent with NUREG 1801 with some program exceptions. Alignment contains the CRD Hydraulic Lines connected to the CRDMs under the Reactor Vessel. Reactor water cleanup system piping downstream of the second containment isolation valve, 4 inch NPS or greater that is exposed to treated water >60˚C (>140˚F), is carbon steel, and is not subject to NRC Generic Letter (GL) 88-01 requirements. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-17 (LR-ISG-2011-01)	Stainless steel Heat exchanger tubes exposed to Treated water, Treated borated water	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2011-01) with some program exceptions. The Water Chemistry program will manage reduction of heat transfer for stainless steel heat exchanger tubes exposed to treated water. The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. There are no stainless steel heat exchanger tubes subject to aging management review in the Auxiliary systems that are exposed to treated borated water. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-18	Stainless steel High- pressure pump, casing, Piping, piping components, and piping elements exposed to Treated borated water >60˚C (>140˚F), Sodium pentaborate solution >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not applicable. There are no stainless steel high pressure pump or piping components subject to aging management review in the Auxiliary systems that are exposed to treated borated water >60˚C (>140˚F) or sodium pentaborate solution >60˚C (>140˚F).
3.3.1-19	Stainless steel Regenerative heat exchanger components exposed to Treated water >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not applicable. The regenerative heat exchanger components subject to aging management review in the Auxiliary Systems are made of steel and cracking is not one of its aging effects.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-20	Stainless steel, Stainless steel; steel with stainless steel cladding Heat exchanger components exposed to Treated borated water >60˚C (>140˚F), Treated water >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage cracking of stainless steel piping and valves exposed to treated water >60˚C (>140˚F). In addition to components in the Auxiliary systems, the Water Chemistry program will manage cracking of Residual Heat Removal heat exchanger tubes and Reactor Recirculation pump seal coolers exposed to treated water >60˚C (>140˚F). The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. There are no stainless steel or steel with stainless steel cladding heat exchanger components subject to aging management review in the Auxiliary systems that are exposed to treated water >60˚C (>140˚F). See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.3.1-21	Steel Piping, piping components, and piping elements	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 with the following clarifications and with some program exceptions. The Water Chemistry program will manage loss of material for steel

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
	exposed to Treated water				components exposed to treated water, and the One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. In addition, loss of material for steel components in the Standby Liquid Control system exposed to sodium pentaborate solution are also aligned to this item but managed with a different program. Sodium pentaborate is a subset of treated water that results in similar aging effects for steel components. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components will manage loss of material for these steel lines, which are test lines, system drains or tank overflow lines exposed to this environment but typically are drained. They are conservatively modeled as containing sodium pentaborate. Loss of material in Flex piping and piping components in storage for the Standby Liquid Control system and subjected to unmonitored treated water is aligned with this item but managed with a different program, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					Components. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.3.1-22	Copper alloy Piping, piping components, and piping elements exposed to Treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage loss of material for copper alloy components exposed to treated water, and the One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.3.1-23	Aluminum Piping, piping components, and piping elements exposed to Treated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not applicable. Loss of material for aluminum components exposed to treated water in the Auxiliary Systems is addressed in item 3.3.1-25.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-24	Aluminum Piping, piping components, and piping elements exposed to Treated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Consistent with NUREG-1801 with the following clarifications and with some program exceptions. This item is not used in the Auxiliary systems. Loss of material for aluminum components subject to aging management review in the Auxiliary systems exposed to treated water is addressed in item 3.3.1-25. The Water Chemistry program will manage cracking and loss of material for Aluminum fuel pool liner plates and gates subject to aging management review in the Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures. The One-Time Inspection program will confirm the effectiveness of the chemistry program. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-25	Stainless steel, Stainless steel; steel with stainless steel cladding, Aluminum Piping, piping components, and piping elements, Heat exchanger components exposed to Treated water, Sodium pentaborate solution	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 for most components and with some program exceptions. The Water Chemistry program will manage loss of material in aluminum and stainless steel components exposed to treated water or sodium pentaborate solution, and the One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. The Bolting Integrity program will manage loss of material for submerged stainless steel bolting associated with fuel storage racks. In addition to the Auxiliary systems, Stainless Steel Boundary Valves in the Reactor Coolant Pressure Boundary System exposed to sodium pentaborate solution are also aligned to this row. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-26 (LR-ISG-2013-01)	Steel (with stainless steel cladding) Piping, piping components, and piping elements exposed to Treated water	Loss of material due to pitting and crevice corrosion (only after cladding degradation)	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not applicable. There are no steel with stainless steel cladding components subject to aging management review in the Auxiliary systems that are exposed to treated water.
3.3.1-27	Stainless steel Heat exchanger tubes exposed to Treated water	Reduction of heat transfer due to fouling	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage reduction of heat transfer for stainless steel heat exchanger tubes exposed to treated water, and the One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.3.1-28 (LR-ISG-2011-01)	PWR only				
3.3.1-29 (LR-ISG-2011-01)	PWR only				

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-30	Concrete; cementitious material Piping, piping components, and piping elements exposed to Raw Water	Changes in material properties due to aggressive chemical attack	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no concrete or cementitious piping components subject to aging management review in the Auxiliary systems that are exposed to raw water. Cement-lined piping in the Fire Protection system is addressed in items 3.3.1-138 and 3.3.1-139.
3.3.1-30x	Fiberglass, HDPE Piping, piping components, and piping elements exposed to Raw water (internal)	Cracking, blistering, change in color due to water absorption	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801 for material, environment and aging effect with a different program assignment. The Fire Water System program will manage change in material properties and blistering of ASTM D-2996 fiberglass reinforced epoxy piping in the Fire Protection system.
3.3.1-31	Concrete; cementitious material Piping, piping components, and piping elements exposed to Raw Water	Cracking due to settling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no concrete or cementitious piping components subject to aging management review in the Auxiliary systems that are exposed to raw water. Cement-lined piping in the Fire Protection system is addressed in items 3.3.1-138 and 3.3.1-139.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-32	Reinforced concrete, asbestos cement Piping, piping components, and piping elements exposed to Raw water	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no reinforced concrete or asbestos piping components subject to aging management review in the Auxiliary systems that are exposed to raw water.
3.3.1-32x	Elastomer seals and components exposed to raw water	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no elastomer components subject to aging management review in the Auxiliary systems that are exposed to raw water.
3.3.1-33	Concrete; cementitious material Piping, piping components, and piping elements exposed to Raw Water	Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no concrete or cementitious piping components subject to aging management review in the Auxiliary systems that are exposed to raw water. Cement-lined piping in the Fire Protection system is addressed in items 3.3.1-138 and 3.3.1-139.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-34	Nickel alloy, Copper alloy Piping, piping components, and piping elements exposed to Raw water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no nickel alloy components subject to aging management review in the Auxiliary systems that are exposed to raw water. Loss of material for copper alloy piping components exposed to raw water, managed by the Open-Cycle Cooling Water System is addressed in items 3.3.1-36.
3.3.1-35	Copper alloy Piping, piping components, and piping elements exposed to Raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. Loss of material for copper alloy piping components exposed to raw water in the Auxiliary systems and managed by the Open-Cycle Cooling Water System is addressed in item 3.3.1-36.
3.3.1-36	Copper alloy Piping, piping components, and piping elements exposed to Raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System will manage loss of material of copper alloy piping components exposed to raw water in the Emergency Service Water and Plant Radiation Monitoring and Process Monitoring systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-37 (LR-ISG-2013-01)	Steel Piping, piping components, and piping elements exposed to Raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2013-01). The Open-Cycle Cooling Water System program will manage loss of material for steel piping components exposed to raw water.
3.3.1-38	Copper alloy, Steel Heat exchanger components exposed to Raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801 for most components, but with a different program for submerged bolting. The Open-Cycle Cooling Water program will manage loss of material for steel and copper alloy heat exchanger components exposed to raw water whose source is the Emergency Service Water system. The Bolting Integrity program will manage loss of material for steel pump casing bolting submerged in raw water.
3.3.1-39	Stainless steel Piping, piping components, and piping elements exposed to Raw water	Loss of material due to pitting and crevice corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. Loss of material for stainless steel components in raw water, managed by the Open-Cycle Cooling Water System program is addressed in item 3.3.1-40.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-40	Stainless steel Piping, piping components, and piping elements exposed to Raw water	Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System will manage loss of material for stainless steel components exposed to raw water in the Emergency Closed Cooling, Emergency Service Water, Emergency Service Water Screen Wash, and Plant Radiation Monitoring and Process Monitoring systems. Heat Exchanger tubes and tubesheets in the Emergency Closed Cooling Water system are also aligned to this row.
3.3.1-41	Stainless steel Piping, piping components, and piping elements exposed to Raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. Loss of material for stainless steel components in raw water, managed by the Open-Cycle Cooling Water System program is addressed in item 3.3.1-40.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-42	Copper alloy, Titanium, Stainless steel Heat exchanger tubes exposed to Raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801 for most components in the Emergency Closed Cooling and Emergency Service Water systems, and consistent for material, environment and aging effect with a different program assigned for components in the Fire Protection system. The Open-Cycle Cooling Water System program will manage reduction of heat transfer for copper alloy and stainless steel heat exchanger tubes exposed to raw water in in the Emergency Closed Cooling and Emergency Service Water systems. In the Fire Protection system, the Fire Water System program will manage reduction of heat transfer for the copper alloy diesel-driven fire pump jacket water heat exchanger tubes exposed to raw water. There are no titanium heat exchanger tubes subject to aging management and exposed to raw water in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-43	Stainless steel Piping, piping components, and piping elements exposed to Closed- cycle cooling water >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801.The Closed Treated Water Systems program will manage cracking of stainless steel piping components exposed to closed-cycle cooling water >60˚C (>140˚F) in the Building Heating system.
3.3.1-44	Stainless steel; steel with stainless steel cladding Heat exchanger components exposed to Closed-cycle cooling water >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no stainless steel or steel with stainless steel heat exchanger components subject to aging management that are exposed to closed-cycle cooling water >60˚C (>140˚F) in the Auxiliary systems.
3.3.1-45	Steel Piping, piping components, and piping elements; tanks exposed to Closed- cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801.The Closed Treated Water Systems program will manage loss of material for steel piping components and tanks exposed to closed-cycle cooling water.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-46	Steel, Copper alloy Heat exchanger components, Piping, piping components, and piping elements exposed to Closed- cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. The Closed Treated Water Systems program will manage loss of material for steel and copper alloy heat exchanger and piping components exposed to closed-cycle cooling water.
3.3.1-47	Stainless steel; steel with stainless steel cladding Heat exchanger components exposed to Closed-cycle cooling water	Loss of material due to microbiologically-influenced corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. The Closed Treated Water Systems program will manage loss of material for stainless steel and steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water.
3.3.1-48	Aluminum Piping, piping components, and piping elements exposed to Closed- cycle cooling water	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no aluminum piping components subject to aging management review in the Auxiliary systems that are exposed to closed-cycle cooling water.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-49	Stainless steel Piping, piping components, and piping elements exposed to Closed- cycle cooling water	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. The Closed Treated Water Systems program will manage loss of material for stainless steel components exposed to closed-cycle cooling water. In addition, heat exchanger components in the Fuel Pool Cooling and Cleanup system and the Control Complex Chilled Water system are also aligned to this row for managing loss of material.
3.3.1-50	Stainless steel, Copper Alloy, Steel Heat exchanger tubes exposed to Closed- cycle cooling water	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. The Closed Treated Water Systems program will manage reduction of heat transfer of stainless steel and copper alloy heat exchanger tubes exposed to closed-cycle cooling water. There are no steel heat exchanger tubes subject to aging management review in the Auxiliary systems that are exposed to closed-cycle cooling water.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-51	Boraflex Spent fuel storage racks: neutron-absorbing sheets (PWR), Spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to Treated borated water, Treated water	Reduction of neutron-absorbing capacity due to Boraflex degradation	Chapter XI.M22, “Boraflex Monitoring”	No	Not applicable. There are no Boraflex neutron-absorbers subject to aging management review at PNPP. Aging management of Boral neutron absorbers is described in item 3.3.1-102.
3.3.1-52	Steel Cranes: rails and structural girders exposed to Air – indoor, uncontrolled (External)	Loss of material due to general corrosion	Chapter XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems”	No	Consistent with NUREG-1801. This item is not used in the Auxiliary systems. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will manage loss of material for steel crane rails and structural girders subject to aging management in the Containment Structure, Water Control Structures, and the Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures and exposed to air-indoor, uncontrolled.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-53	Steel Cranes - rails exposed to Air – indoor, uncontrolled (External)	Loss of material due to wear	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	Not applicable. This line item was not used for the Auxiliary systems. Steel crane rails subject to aging management exposed to air-indoor, uncontrolled environment are addressed under items 3.3.1-52, 3.5.1-77 and 3.5.1-92.
3.3.1-54	Copper alloy Piping, piping components, and piping elements exposed to Condensation	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No	Not applicable. Components exposed to compressed air downstream of air dryers are assigned the Air - dry environment. Aging evaluations for these components were compared to NUREG-1801 rows for dry air that recommended no aging management program, but were assigned the Compressed Air Monitoring program to ensure that a dried air environment is maintained. See item 3.3.1-114. Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components manages loss of material in copper alloy piping, piping components and piping elements subject to aging management and exposed to internal condensation in the Service Air and Instrument Air systems, see item 3.3.1-89.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-55	Steel Piping, piping components, and piping elements: compressed air system exposed to Condensation (Internal)	Loss of material due to general and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No	Not applicable. Components exposed to compressed air downstream of air dryers are assigned the Air - dry environment. Aging evaluations for these components were compared to NUREG-1801 rows for dry air that recommended no aging management program, but were assigned the Compressed Air Monitoring program to ensure that a dried air environment is maintained. See item 3.3.1-121. Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components manages loss of material in steel piping, piping components and piping elements subject to aging management and exposed to internal condensation in the Service Air, Instrument Air and Safety Related Instrument Air systems, see item 3.3.1-95.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-56	Stainless steel Piping, piping components, and piping elements exposed to Condensation (Internal)	Loss of material due to pitting and crevice corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No	Not applicable. Components exposed to compressed air downstream of air dryers are assigned the Air - dry environment. Aging evaluations for these components were compared to NUREG-1801 rows for dry air that recommended no aging management program, but were assigned the Compressed Air Monitoring program to ensure that a dried air environment is maintained. See item 3.3.1-120. Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components manages loss of material in stainless steel piping, piping components and piping elements subject to aging management and exposed to internal condensation in the Service Air, Instrument Air and Safety Related Instrument Air systems, see item 3.3.1-95.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-57	Elastomers Fire barrier penetration seals exposed to Air - indoor, uncontrolled, Air – outdoor	Increased hardness; shrinkage; loss of strength due to weathering	Chapter XI.M26, "Fire Protection"	No	Consistent with NUREG-1801 with the following clarifications: This item is not used by the Auxiliary Systems. The Fire Protection Program will manage change in material properties and cracking of elastomer fire barrier penetration sealant, seismic isolation Joint, and fire stop commodities subject to aging management and exposed to air - indoor in the Bulk Civil Commodities. Other elastomer fire penetration seals exposed to air are addressed under items 3.5.1-33 and 3.5.1-72.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-58	Steel Halon/carbon dioxide fire suppression system piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M26, "Fire Protection"	No	Consistent with NUREG-1801. The Fire Protection program will manage loss of material for steel carbon dioxide system piping components exposed to air - indoor, uncontrolled. There are no Halon system components subject to aging management in the Auxiliary systems. In addition to the Auxiliary systems, the Fire Protection Program will manage loss of material for steel Containment Isolation Dampers for U2 Containment Isolation (2M14), Fire Damper Housing, Fire Damper Housing 2M15, Flood curbs, and Louver and Damper housings including 2M49 Fire Dampers in the Bulk Civil Commodities and steel Drywell mechanical penetrations and Fuel Transfer tube penetration in the Containment Structure, Unit 1, subject to aging management and exposed to air - indoor.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-59	Steel Fire rated doors exposed to Air - indoor, uncontrolled, Air – outdoor	Loss of material due to wear	Chapter XI.M26, "Fire Protection"	No	Consistent with NUREG-1801 with the following clarifications: This line item was not used for the Auxiliary systems. The Fire Protection Program will manage loss of material for steel Damper and louver housings and fixed louvers2, and Fire door and barriers, Tornado Doors in the Bulk Civil Commodities and Drywell electrical penetrations in the Containment Structure, Unit 1, subject to aging management and exposed to air - indoor. Steel fire doors and barriers exposed to air are addressed under item 3.5.1-92.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-60	Reinforced concrete Structural fire barriers: walls, ceilings and floors exposed to Air - indoor, uncontrolled	Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. This item is not used in the Auxiliary systems. The Fire Protection and Structures Monitoring programs will manage cracking of concrete fire barriers exposed to Air - indoor, uncontrolled environment including beams, columns, floor and roof slabs and interior walls, and ceiling of DDFP Room, manway, hatches, manhole and hatch covers drywell, shield building cylinder wall and dome subject to aging management in the Bulk Civil Commodities, Water Control Structures, and the Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures and Containment Structure, Unit 1.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-61	Reinforced concrete Structural fire barriers: walls, ceilings and floors exposed to Air – outdoor	Cracking, loss of material due to freeze- thaw, aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, “Fire Protection,” and Chapter XI.S6, “Structures Monitoring”	No	Consistent with NUREG-1801 with the following clarifications: This line item was not used for the Auxiliary systems. The Fire Protection program will manage change in material properties and cracking for concrete fire barriers exposed to air-outdoor in the Bulk Civil Commodities. Reinforced concrete exposed to air-outdoor environment other than structural fire barriers are addressed under item 3.5.1-66.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-62	Reinforced concrete Structural fire barriers: walls, ceilings and floors exposed to Air - indoor, uncontrolled, Air – outdoor	Loss of material due to corrosion of embedded steel	Chapter XI.M26, “Fire Protection,” and Chapter XI.S6, “Structures Monitoring”	No	Consistent with NUREG-1801 with the following clarifications: This line item was not used for the Auxiliary systems. The Fire Protection program will manage loss of material and including corrosion of embedded steel reinforcing for concrete fire barriers exposed to air-outdoor in the Bulk Civil Commodities. Concrete barriers other than reinforced concrete Structural fire barriers exposed to air environments subject to aging management for loss of material and including corrosion of embedded steel are addressed under item 3.5.1-66.
3.3.1-63	Steel Fire Hydrants exposed to Air – outdoor	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M27, "Fire Water System"	No	Consistent with NUREG-1801. The Fire Water System program will manage loss of material for gray cast iron fire hydrants exposed to an air - outdoor environment.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-64 (LR-ISG-2012-02)	Steel, Copper alloy Piping, piping components, and piping elements exposed to Raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The Fire Water System program will manage loss of material and flow blockage in steel and copper alloy components exposed to raw water in the Fire Protection system. Steel is used here in the broad category of carbon steel, alloy steel, cast iron, gray cast iron, malleable iron, and high-strength low-alloy, steel. All are vulnerable to loss of material due to the various aging mechanisms cited under this table 1 item number. In addition, fire pump steel bolting in the Fire Protection system that is submerged in raw water is aligned to this row but will be managed for loss of material under the Bolting Integrity program.
3.3.1-65 (LR-ISG-2012-02)	Aluminum Piping, piping components, and piping elements exposed to Raw water	Loss of material due to pitting and crevice corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Not applicable. There are no aluminum components subject to aging management review in the Fire Protection system that are exposed to raw water.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-66 (LR-ISG-2012-02)	Stainless steel Piping, piping components, and piping elements exposed to Raw water	Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The Fire Water System program will manage loss of material of stainless steel piping components exposed to raw water in the Fire Protection system.
3.3.1-67 (LR-ISG-2012-02)	Steel Tanks exposed to Air – outdoor (External)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not applicable. There are no steel tanks subject to aging management review in the Auxiliary systems that are exposed to air - outdoor.
3.3.1-68	Steel Piping, piping components, and piping elements exposed to Fuel oil	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection"	No	Not applicable. Loss of material for steel components in fuel oil are aligned to item 3.3.1-70.
3.3.1-69	Copper alloy Piping, piping components, and piping elements exposed to Fuel oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M30, "Fuel Oil Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. The Fuel Oil Chemistry program will manage loss of material for copper alloy piping components exposed to fuel oil, and the One-Time Inspection program will be used to confirm the effectiveness of the Fuel Oil Chemistry program.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-70	Steel Piping, piping components, and piping elements; tanks exposed to Fuel oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M30, "Fuel Oil Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 for most components. The Fuel Oil Chemistry program will manage loss of material for steel piping components and tanks exposed to fuel oil, and the One-Time Inspection program will be used to confirm the effectiveness of the Fuel Oil Chemistry program. Materials susceptible to selective leaching subjected to water contaminated fuel oil are managed under the Fuel Oil Chemistry and One-Time Inspection programs. These programs assure the exclusion of water. Furthermore, NUREG 2191 Selective Leaching AMP no longer includes water contaminated fuel oil environments. Also, steel floor and equipment drain pans and funnels in the Floor and Equipment Drain system exposed to fuel oil are aligned to this row but are managed for loss of material under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-71	Stainless steel, Aluminum Piping, piping components, and piping elements exposed to Fuel oil	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M30, "Fuel Oil Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 for most components. The Fuel Oil Chemistry program will manage loss of material for stainless steel piping components exposed to fuel oil, and the One-Time Inspection program will be used to confirm the effectiveness of the Fuel Oil Chemistry program. There are no tanks (stainless steel or aluminum) nor aluminum piping components subject to aging management review in the Auxiliary systems that are exposed to fuel oil. Also, stainless steel floor and equipment drain pans and funnels in the Floor and Equipment Drain system exposed to fuel oil are aligned to this row but are managed for loss of material under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-72 (LR-ISG-2012-02)	Gray cast iron, Copper alloy (>15% Zn or >8% Al) Piping, piping components, and piping elements, Heat exchanger components exposed to Treated water, Closed-cycle cooling water, Soil, Raw water, Waste water	Loss of material due to selective leaching	Chapter XI.M33, “Selective Leaching”	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02) and with some program exceptions. The Selective Leaching program will manage loss of material due to selective leaching for gray cast iron and copper alloy (>15% Zn) components exposed to treated water, closed-cycle cooling water, soil, raw water, waste water. In addition, to the Auxiliary systems, gray cast iron heat exchanger components exposed to Closed-cycle cooling water in the Off Gas system are also aligned to this row. See Appendix B Section B.2.42 for Selective Leaching program exceptions to NUREG-1801.
3.3.1-73	Concrete; cementitious material Piping, piping components, and piping elements exposed to Air - outdoor	Changes in material properties due to aggressive chemical attack	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. There are no concrete or cementitious material piping components subject to aging management review in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-74	Concrete; cementitious material Piping, piping components, and piping elements exposed to Air - outdoor	Cracking due to settling	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. There are no concrete or cementitious material piping components subject to aging management review in the Auxiliary systems.
3.3.1-75	Reinforced concrete, asbestos cement Piping, piping components, and piping elements exposed to Air – outdoor	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. There are no reinforced concrete or asbestos cement piping components subject to aging management review in the Auxiliary systems.
3.3.1-76	Elastomers Elastomer: seals and components exposed to Air – indoor, uncontrolled (Internal/External)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801 for most components. The External Surfaces Monitoring of Mechanical Components program manages degradation of internal and external surfaces of ventilation flexible connections made of asbestos-polyester cloth reinforced with Dow Nordel™ (EPDM) that are exposed to air - indoor, uncontrolled on both internal and external surfaces. In addition to the Auxiliary systems, External Surfaces Monitoring of Mechanical

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Components will manage hardening and loss of strength in elastomer flexible connections subject to aging management in the Annulus Exhaust Gas Treatment system exposed to Air-indoor, uncontrolled (internal) and are aligned to this row with exposure to Air-indoor, uncontrolled (external) aligned to row item 3.2.1-38. ESF Ventilation ductwork silicone sealant will continue to be age managed under Commitment L01090. The Structures Monitoring program will manage change in material properties and cracking for elastomer, Tefzel Ties commodities subject to aging management in the Bulk Civil Commodities and exposed to air-indoor, uncontrolled. The External Surfaces of Mechanical Components will manage the same aging effect for elastomer insulation commodities subject to aging management in the Bulk Civil Commodities and exposed to air-indoor, uncontrolled.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-77	Concrete; cementitious material Piping, piping components, and piping elements exposed to Air - outdoor	Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. There are no concrete or cementitious material piping components subject to aging management review in the Auxiliary systems.
3.3.1-78	Steel Piping and components (External surfaces), Ducting and components (External surfaces), Ducting; closure bolting exposed to Air – indoor, uncontrolled (External), Air – indoor, uncontrolled (External), Air – outdoor (External), Condensation (External)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801 for most components. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for most steel components exposed to air - indoor, uncontrolled, air - outdoor, and condensation environments. In addition to components in the Auxiliary systems, the External Surfaces Monitoring of Mechanical Components program will manage loss of material for steel components in the Reactor Recirculation system. The Fire Protection program will manage loss of material for steel CO2 fire protection piping in air - outdoor.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-79	Copper alloy Piping, piping components, and piping elements exposed to Condensation (External)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for copper alloy components exposed to condensation.
3.3.1-80	Steel Heat exchanger components, Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External), Air – outdoor (External)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for steel components exposed to air - indoor, uncontrolled and air - outdoor. In addition to external surfaces, this program is used to manage aging effects on the internal surfaces of components exposed to air-outdoor when the external surface is the same or more severe environment. So monitoring the external surfaces will be indicative of internal surface.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-81	Copper alloy, Aluminum Piping, piping components, and piping elements exposed to Air – outdoor (External), Air - outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801 for most components. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for copper alloy and aluminum components in the Auxiliary systems exposed to air - outdoor. The Fire Water System program will manage loss of material for copper alloy spray nozzles in the Fire Protection system exposed to air-outdoor. In addition to the Auxiliary systems, aluminum insulation jacketing commodity subject to aging management in the Bulk Civil Commodities is aligned with this item.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-82	Elastomers Elastomer: seals and components exposed to Air – indoor, uncontrolled (External)	Loss of material due to wear	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. The External Surfaces Monitoring of Mechanical Components program will manage the aging effects of elastomers exposed to Air-indoor uncontrolled. Aging effects for the ventilation flexible connections made of asbestos-polyester cloth reinforced with Dow Nordel™ (EPDM) are also addressed in item 3.3.1-76. In addition to the Auxiliary systems, External Surfaces Monitoring of Mechanical Components will manage loss of material in elastomer flexible connections subject to aging management in the Annulus Exhaust Gas Treatment system exposed to Air-indoor, uncontrolled. Aging effects for ESF ductwork sealant will continue to be managed under Commitment L01090, which monitors silicone sealant samples in an Auxiliary system (Miscellaneous Area Ventilation system). There are no other elastomer components subject to aging management review in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-83	Stainless steel Diesel engine exhaust piping, piping components, and piping elements exposed to Diesel exhaust	Cracking due to stress corrosion cracking	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage cracking of stainless steel components exposed to diesel exhaust. In addition to the Auxiliary systems, the Structures Monitoring program will manage cracking of stainless steel, Diesel Exhaust hallway insulation bolting1 subject to aging management review in the Bulk Civil Commodities.
3.3.1-84	There is no NUREG-1800 item 3.3.1-84				
3.3.1-85	Elastomers Elastomer seals and components exposed to Closed- cycle cooling water	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable. There are no elastomer components subject to aging management review in the Auxiliary systems that are exposed to closed-cycle cooling water.
3.3.1-86	Elastomers Elastomers, linings, Elastomer: seals and components exposed to Treated borated	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable. There are no elastomer components subject to aging management review in the Auxiliary systems that are exposed to treated borated water, treated water or raw water.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
	water, Treated water, Raw water				
3.3.1-87	There is no NUREG-1800 item 3.3.1-87				
3.3.1-88	Steel; stainless steel Piping, piping components, and piping elements, Piping, piping components, and piping elements, diesel engine exhaust exposed to Raw water (potable), Diesel exhaust	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for steel and stainless steel components exposed to diesel exhaust in the Fire Protection and Diesel Generator Air Intake and Exhaust systems and to raw water in the Potable Water Supply system. In addition to the Auxiliary systems, the Structures Monitoring program will manage loss of material for stainless steel, Diesel Exhaust hallway insulation bolting1 subject to aging management review in the Bulk Civil Commodities.
3.3.1-89 (LR-ISG-2012-02)	Steel, Copper alloy Piping, piping components, and piping elements exposed to Moist air or condensation (Internal)	Loss of material due to general, pitting, and crevice corrosion	For fire water system components: Chapter XI.M27, "Fire Water System," or for other components: Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02) for most components. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for steel and copper alloy piping components exposed to air - indoor,

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
			and Ducting Components"		uncontrolled, air - outdoor, and condensation. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for steel roof drain strainer bodies exposed to outdoor air in the Floor and Equipment Drains system. Moist air or condensation (Internal) is considered equivalent to Outdoor air. The external surface of copper alloy heat exchanger tubes and components within ventilation units are also aligned to this item, as they are internal to the ventilation units. The internal surfaces of steel heat exchanger shells exposed to Air – indoor, uncontrolled environment in the Diesel Generator Jacket water system are also aligned to this item. PNPP does not have any fire water system steel or copper alloy components subject to aging management exposed to internal moist air or condensation (internal) environments.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-90	Steel Ducting and components (Internal surfaces) exposed to Condensation (Internal)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically-influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for steel components exposed to condensation (internal).
3.3.1-91	Steel Piping, piping components, and piping elements; tanks exposed to Waste Water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for steel components exposed to waste water. In addition to components in the Auxiliary systems, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for components in the Respirator Cleaning system and Annulus Exhaust Gas Treatment system.
3.3.1-92	Aluminum Piping, piping components, and piping elements exposed to Condensation (Internal)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for aluminum components that are exposed to condensation in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-93	Copper alloy Piping, piping components, and piping elements exposed to Raw water (potable)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for copper alloy components exposed to raw water in the Potable Water Supply system.
3.3.1-94	Stainless steel Ducting and components exposed to Condensation	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable. There are no stainless steel ducting components subject to aging management review in the Auxiliary systems that are exposed to condensation. Loss of material for other stainless steel components in the Auxiliary systems exposed to condensation (internal) is addressed in item 3.3.1-95.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-95	Copper alloy, Stainless steel, Nickel alloy, Steel Piping, piping components, and piping elements, Heat exchanger components, Piping, piping components, and piping elements; tanks exposed to Waste water, Condensation (Internal)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for copper alloy, stainless steel and steel components exposed to waste water or condensation (internal). In addition to Auxiliary systems components, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for stainless steel components in the Respirator Cleaning system, and will manage loss of material for stainless steel, sump liners and penetrations commodities subject to aging management and exposed to waste water in the Containment Structure and Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-96	Elastomers Elastomer: seals and components exposed to Air – indoor, uncontrolled (Internal)	Loss of material due to wear	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801 with the following clarifications: The External Surfaces Monitoring of Mechanical Components program will manage the loss of material due to wear of elastomers exposed to the same internal and external environments. The Aging effects for the ventilation flexible connections made of asbestos-polyester cloth reinforced with Dow Nordel™ (EPDM) are also addressed in item 3.3.1-76. In addition to the Auxiliary systems, elastomer flexible connections subject to aging management in the Annulus Exhaust Gas Treatment system exposed to Air-indoor, uncontrolled are aligned to this row. Aging effects for ESF ductwork sealant will continue to be managed under Commitment L01090, which monitors silicone sealant samples in an Auxiliary system (Miscellaneous Area Ventilation system). There are no other elastomer components subject to aging management review in the Auxiliary systems.

3.3.1-97	Steel Piping, piping components, and piping elements, Reactor coolant pump oil collection system: tanks, Reactor coolant pump oil collection system: piping, tubing, valve bodies exposed to Lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 for most components. The Lubricating Oil Analysis program will manage loss of material for steel components exposed to lubricating oil. In addition to Auxiliary systems components, the Lubricating Oil Analysis program will manage loss of material for steel components in the Reactor Recirculation system exposed to Fyrquel hydraulic fluid. The One-Time Inspection program will be used to confirm the effectiveness of the Lubricating Oil Analysis program. Materials susceptible to selective leaching subjected to water contaminated lube oil are managed under the Lubricating Oil Analysis and One-Time Inspection programs. These programs assure the exclusion of water. Furthermore, NUREG 2191 Selective Leaching AMP no longer includes water contaminated lube oil environments. Also, steel floor and equipment drain pans and funnels in the Floor and Equipment Drain system exposed to lube oil are aligned to this row but are managed for loss of material under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.
3.3.1-98	Steel Heat exchanger	Loss of material due to general, pitting,	Chapter XI.M39, "Lubricating Oil	No	Consistent with NUREG-1801. The Lubricating Oil Analysis program

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
	components exposed to Lubricating oil	crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Analysis," and Chapter XI.M32, "One-Time Inspection"		will manage loss of material for steel heat exchanger components exposed to lubricating oil. In addition to Auxiliary systems components, the Lubricating Oil Analysis program will manage loss of material for steel components in the Reactor Recirculation system exposed to Fyrquel hydraulic fluid. The One-Time Inspection program will be used to confirm the effectiveness of the Lubricating Oil Analysis program.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-99	Copper alloy, Aluminum Piping, piping components, and piping elements exposed to Lubricating oil	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, “One-Time Inspection”	No	Consistent with NUREG-1801 for most components. The Lubricating Oil Analysis program will manage loss of material for copper alloy and aluminum piping components exposed to lubricating oil. Heat exchanger components in various Auxiliary systems with the same material, environment, and aging effect are also aligned to this row item. In addition to Auxiliary systems components, the Lubricating Oil Analysis program will manage loss of material for copper alloy and aluminum components in the Reactor Recirculation system exposed to Fyrquel hydraulic fluid. The One-Time Inspection program will be used to confirm the effectiveness of the Lubricating Oil Analysis program.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-100	Stainless steel Piping, piping components, and piping elements exposed to Lubricating oil	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 for most components. The Lubricating Oil Analysis program will manage loss of material for stainless steel piping components exposed to lubricating oil. Heat exchanger components in various Auxiliary systems with the same material, environment, and aging effect are also aligned to this row item. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material of stainless steel drains exposed to lubricating oil in the Floor and Equipment Drains system. In addition to Auxiliary systems components, the Lubricating Oil Analysis program will manage loss of material for stainless steel components in the Reactor Recirculation system exposed to Fyrquel hydraulic fluid. The One-Time Inspection program will be used to confirm the effectiveness of the Lubricating Oil Analysis program.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-101	Aluminum Heat exchanger tubes exposed to Lubricating oil	Reduction of heat transfer due to fouling	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801: The Lubricating Oil Analysis will manage reduction of heat transfer for aluminum heat exchanger tube fins exposed to lubricating oil.
3.3.1-102	Boral®; boron steel, and other materials (excluding Boraflex) Spent fuel storage racks: neutron-absorbing sheets (PWR), Spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to Treated borated water, Treated water	Reduction of neutron-absorbing capacity; change in dimensions and loss of material due to effects of SFP environment	Chapter XI.M40, "Monitoring of Neutron-Absorbing Materials other than Boraflex"	No	Consistent with NUREG-1801. The Monitoring of Neutron-Absorbing Materials other than Boraflex program will manage change in dimension, loss of material and reduction of neutron absorption for Boral neutron absorbers exposed to treated water.
3.3.1-103	Reinforced concrete, asbestos cement Piping, piping components, and piping elements exposed to Soil or concrete	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There are no reinforced concrete or asbestos cement piping components subject to aging management review in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-104	HDPE, Fiberglass Piping, piping components, and piping elements exposed to Soil or concrete	Cracking, blistering, change in color due to water absorption	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. The Buried and Underground Piping and Tanks program will manage change in material properties and blistering (these aging effects are considered to be equivalent to cracking, blistering and change in color) for fiberglass piping exposed to soil in the Fire Protection program. There is no HDPE piping subject to aging management review in the Auxiliary systems.
3.3.1-105	Concrete cylinder piping, Asbestos cement pipe Piping, piping components, and piping elements exposed to Soil or concrete	Cracking, spalling, corrosion of rebar due to exposure of rebar	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There are no concrete cylinder or asbestos cement piping components subject to aging management review in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-106	Steel (with coating or wrapping) Piping, piping components, and piping elements exposed to Soil or concrete	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. The Buried and Underground Piping and Tanks program will manage loss of material for steel components exposed to soil. Effectiveness of special coatings or wrappings on buried components is not credited for completely mitigating aging effects throughout the period of extended operation. Steel piping components subject to aging management in the Auxiliary systems that are exposed to concrete are addressed in 3.3.1-112.
3.3.1-107 (LR-ISG-2011-03)	Stainless steel, nickel alloy piping, piping components, and piping elements exposed to Soil or concrete	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801, as modified by LR-ISG-2011-03. The Buried and Underground Piping and Tanks program will manage loss of material for stainless steel piping components exposed to soil. There are no nickel alloy components subject to aging management in the Auxiliary systems that are exposed to soil.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-108 (LR-ISG-2011-03)	Titanium, super austenitic, aluminum, copper alloy, stainless steel, nickel alloy piping, piping components, and piping elements, bolting exposed to soil or concrete	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. Loss of material for stainless steel components in the Auxiliary systems exposed to soil is addressed in item 3.3.1-107. There are no titanium, super austenitic, aluminum, copper alloy, or nickel alloy piping components subject to aging management in the Auxiliary systems that are exposed to soil or concrete.
3.3.1-109	Steel Bolting exposed to Soil or concrete	Loss of material due to general, pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. The Buried and Underground Piping and Tanks program will manage loss of material for steel bolting exposed to soil. There is no steel bolting subject to aging management review in the Auxiliary systems that is exposed to concrete.
3.3.1-109x (LR-ISG-2011-03)	Underground aluminum, copper alloy, stainless steel, nickel alloy steel piping, piping components, and piping elements	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There are no underground (in vaults or tunnels outside of buildings) aluminum, copper alloy, stainless steel or nickel alloy piping components subject to aging management in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-110	Stainless steel Piping, piping components, and piping elements exposed to Treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	Not applicable. There are no stainless steel Auxiliary systems piping components aligned to this item. Components in the Reactor Coolant Pressure Boundary and Reactor Vessel systems within the scope of the BWR Stress Corrosion Cracking program are addressed in item 3.1.1-97. The Water Chemistry program will manage Cracking due to stress corrosion cracking of Stainless Steel Piping, piping components and piping elements in the Auxiliary systems and the One-Time Inspection program will be used to confirm its effectiveness. - See items 3.3.1-20 and 3.4.1-11.
3.3.1-111	Steel Structural steel exposed to Air – indoor, uncontrolled (External)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. This item is not used by Auxiliary systems. The Structures Monitoring program will manage loss of material for steel commodities comprising the Fuel Handling and Refueling Platforms in the Bulk Civil Commodities exposed to Air-indoor, uncontrolled.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-112	Steel Piping, piping components, and piping elements exposed to Concrete	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Consistent with NUREG-1801. Embedded steel components are in concrete that meets the guidelines of ACI-301 and ACI-318. [USAR 3.8.4.2] Concrete around embedded piping is not exposed to aggressive environments as cited in NUREG-1557, and a plant OE search has not identified degradation of concrete around embedded piping. Cast Iron roof drain external surfaces embedded in concrete is aligned with this GALL Item
3.3.1-113	Aluminum Piping, piping components, and piping elements exposed to Air – dry (Internal/External), Air – indoor, uncontrolled (Internal/External), Air – indoor, controlled (External), Gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 with the following clarifications: In addition to Auxiliary systems components, components in the Nuclear Boiler and Reactor Recirculation systems are also aligned to this item. For aluminum components exposed to air - dry in the Nuclear Boiler, Service Air, and Standby Diesel Generator systems, the Compressed Air Monitoring program is assigned to ensure that the air remains dry and free of contaminants supporting the conclusion that no aging effects are expected.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-114	Copper alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (Internal/External), Air – dry, Gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for most components with the following clarifications: Copper alloy heat exchanger components in various Auxiliary systems exposed to Air-indoor, uncontrolled environments are aligned to this item. Item 3.3.1-130 addresses management of flow blockage for copper alloy sprinkler heads exposed to air-indoor, uncontrolled. In addition to Auxiliary systems components, copper piping and valve bodies in the Annulus Exhaust Gas Treatment system and valve bodies in the Reactor Recirculation system are also aligned to this item. For copper components in an air – dry environment, the Compressed Air Monitoring program will ensure that the air remains dry and free of contaminants supporting the conclusion that no aging effects are expected.
3.3.1-115	PWR only				
3.3.1-116	Galvanized steel Piping, piping components, and piping elements	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 with the following clarifications. Zinc valve bodies in the Diesel Generator Control Air and Start Air

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
	exposed to Air - indoor, uncontrolled				system are aligined with galvanized steel in this item. The Compressed Air Monitoring program is assigned to the internal environment to provide assurance that the quality of the "Air - dry" environment supports the conclusion that no aging effects are expected. In addition to the Auxiliary systems, this item is aligned with external surfaces of different components, namely the Reactor Vessel steel components near rated operating temperature. Applicable aging effects associated with high temperature, fatigue evaluations, and radiation effects are assigned to the internal surfaces subjected to reactor coolant and are not duplicated here. For the purposes of an aging assessment, galvanized steel components are evaluated as steel and these steel surfaces are exposed to drywell air. These components consist of various nozzles, safe ends, nozzle and safe end welds, vessel shell, top and bottom heads and vessel closure flange and welds. In general, if

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					present zinc coating would not credited for corrosion protection.
3.3.1-117	Glass Piping elements exposed to Air – indoor, uncontrolled (External), Lubricating oil, Closed-cycle cooling water, Air – outdoor, Fuel oil, Raw water, Treated water, Treated borated water, Air with borated water leakage, Condensation (Internal/External) Gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 with the following clarifications: Glass components in the Auxiliary systems in various environments are addressed in item 3.3.1-117. There are no nickel alloy components subject to aging management review in the Auxiliary systems.
3.3.1-118	Nickel alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External)	None	None	NA - No AEM or AMP	Not applicable. There are no nickel alloy components subject to aging management review in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-119	Nickel alloy, PVC, Glass Piping, piping components, and piping elements exposed to Air with borated water leakage, Air – indoor, uncontrolled, Condensation (Internal), Waste Water	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 with the following clarifications: The sight glass in the Fire Water System is not PVC, but is a transparent polymer. Glass components in the Auxiliary systems in various environments are addressed in item 3.3.1-117. There are no nickel alloy components subject to aging management review in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-120	Stainless steel Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (Internal/External), Air – indoor, uncontrolled (External), Air with borated water leakage, Concrete, Air – dry, Gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for most components. For components exposed to dried air downstream of air dryers, the Compressed Air Monitoring program is assigned to ensure that the environment will remain dry and free of contaminants supporting the conclusion that no aging effects are expected. In addition to the Auxiliary systems, components exposed to internal environments of air-dry and air-indoor, uncontrolled in the Nuclear Boiler system and Reactor Recirculation system are also aligned to this row. In addition to the Auxiliary systems, stainless steel Base Plates1 exposed to concrete in the Bulk Civil Commodities are also aligned with this item. Also see Item 3.4.1-58 for stainless steel piping components in the Auxiliary systems exposed to Air-indoor, uncontrolled.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-121	Steel Piping, piping components, and piping elements exposed to Air – indoor, controlled (External), Air – dry, Gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for most components. There are no components in air-indoor, controlled aligned with this item. In addition to Auxiliary systems components, gas accumulators in the Reactor Recirculation system are also aligned to this item. For components in an air - dry environment downstream of air dryers, the Compressed Air Monitoring program is assigned to ensure that the environment will remain dry and free of contaminants supporting the conclusion that no aging effects are expected. Gas filled containment vessel electrical penetrations in the Containment Structure are also aligned with this item. Steel storage tanks with internal stainless steel cladding in the Safety Related Instrument Air system exposed to air-dry (internal) are addressed in 3.3.1-120.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-122	Titanium Heat exchanger components, Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled or Air – outdoor	None	None	NA - No AEM or AMP	Not applicable. There are no titanium components subject to aging management review in the Auxiliary systems.
3.3.1-123	Titanium (ASTM Grades 1,2, 7, 11, or 12 that contains > 5% aluminum or more than 0.20% oxygen or any amount of tin) Heat exchanger components other than tubes, Piping, piping components, and piping elements exposed to Raw water	None	None	NA - No AEM or AMP	Not applicable. There are no titanium components subject to aging management review in the Auxiliary systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-124 (LR-ISG-2011-01)	Stainless steel, Steel (with stainless steel or nickel-alloy cladding) Spent fuel storage racks (BWR), Spent fuel storage racks (PWR), Piping, piping components, and piping elements; exposed to Treated water >60˚C (>140˚F), Treated borated water >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not applicable. There are no stainless steel or steel (with stainless steel or nickel-alloy cladding) spent fuel storage racks subject to aging management review in the Auxiliary systems that are exposed to Treated water >60˚C (>140˚F) or Treated borated water >60˚C (>140). Station procedures maintain pool temperature <130˚F. There are no steel (with stainless steel or nickel-alloy cladding) Piping, piping components, and piping elements subject to aging management review in the Auxiliary systems that are exposed to Treated water >60˚C (>140˚F) or Treated borated water >60˚C (>140). In the Auxiliary systems, Water Chemistry and One-Time Inspection program will manage cracking of stainless steel Piping, piping components, and piping elements subject to aging management exposed to Treated water >60˚C (>140˚F). See items 3.3.1-20 and 3.4.1-11.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-125 (LR-ISG-2011-01)	Steel (with stainless steel cladding); stainless steel Spent fuel storage racks (BWR), Spent fuel storage racks (PWR), Piping, piping components, and piping elements exposed to Treated water, Treated borated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection	No	Not applicable. There are no steel (with stainless steel cladding) or stainless steel spent fuel storage racks subject to aging management review in the Auxiliary systems. PNPP fuel storage racks are made of aluminum. Aluminum storage racks and stainless steel Piping components, and piping elements subject to aging management in the Auxiliary systems exposed to treated water are addressed in item 3.3.1-25.
3.3.1-126 (LR-ISG-2012-01)	Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated), raw water	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801 (as modified by ISG-2012-01). The Flow-Accelerated Corrosion program manages wall thinning (loss of material) where operating experience indicates the potential for erosion in treated water and raw water. Piping components in the Emergency Closed Cooling system exposed to closed-cycle cooling water are also aligned to this row, as closed-cooling water is a subset of treated water. There is no component exposed to borated treated water aligned to this item.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-127 (LR-ISG-2012-02)	Metallic piping, piping components, and tanks exposed to raw water or waste water	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion	Yes, plant-specific (See Subsection 3.3.2.2.8)	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The Open Cycle Cooling Water and Fire Water System programs are augmented to address loss of material due to recurrent internal corrosion for steel piping and piping components in the Auxiliary systems as described in Further Evaluation section 3.3.2.2.8. There are no components exposed to waste water and tanks that aligned with this item.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-128 (LR-ISG-2012-02)	Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Loss of material due to general (steel only), pitting, or crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02) for the material, environment and aging effect with the following explanation. There are no steel, stainless steel or aluminum tanks subject to aging management review in the Auxiliary systems that are within the scope of the Aboveground Metallic Tanks program. However, cracking of buried, stainless steel Piping within the Fire Protection System is aligned with this item with the difference of a piping component and the exception that the aging effect is being managed with the Buried and Underground Piping and Tanks Program.
3.3.1-129 (LR-ISG-2012-02)	Steel tanks exposed to soil or concrete; air-indoor uncontrolled, raw water, treated water, waste water, condensation	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not applicable. There are no steel tanks subject to aging management review in the Auxiliary systems that are within the scope of the Aboveground Metallic Tanks program.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-130 (LR-ISG-2012-02)	Metallic sprinklers exposed to air-indoor controlled, air-indoor uncontrolled, air-outdoor, moist air, condensation, raw water, treated water	Loss of material due to general (where applicable), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The Fire Water System program will manage loss of material and flow blockage for metallic sprinkler heads with internal environments of raw water and air – indoor, uncontrolled. The sprinkler heads subject to aging management in the Fire Protection System under the Auxiliary Systems are not exposed to other environments.
3.3.1-131 (LR-ISG-2012-02)	Steel, stainless steel, copper alloy, or aluminum fire water system piping, piping components and piping elements exposed to air-indoor uncontrolled (internal), air-outdoor (internal), or condensation (internal)	Loss of material due to general (steel, and copper alloy only), pitting, crevice, and microbiologically influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The Fire Water System program will manage loss of material and flow blockage for steel and copper alloy fire water piping and piping components with internal environments of air – indoor, uncontrolled and air-outdoor. There is no internal condensation environment in the fire water system components. The dry pipe, outdoor deluge piping is also conservatively evaluated using an internal environment of raw water. The resulting aging effects are the same as this line item (3.3.1-131) and are managed by the same program – the Fire Water System

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					Program. The conservative evaluation subsumes this line item within two other Table 3 line items, 3.3.1-64 and 3.3.1-66. Aluminum piping or piping components (flame arrestors) that are subject to aging management in the Fire Protection system exposed to air-indoor uncontrolled (internal) are addressed in 3.3.1-113 and those exposed to air-outdoor (internal) are addressed in 3.3.1-81. Copper alloy sprinkler heads in the Fire Water System program potentially experiencing internal flow blockage and exposed to air-indoor, uncontrolled are addressed in item 3.3.1-130.
3.3.1-132 (LR-ISG-2012-02)	Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor	Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion; cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only)	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, “Aboveground Metallic Tanks” (for tanks only)	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02) with the following clarifications. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for the external surfaces of insulated steel, stainless steel and copper alloy piping, piping components, tanks and steel heat exchanger chilled water channels in the Auxiliary systems exposed to condensation and will manage cracking for the

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					external surfaces of insulated stainless steel components exposed to condensation. There are no components in the Auxiliary systems exposed to air-outdoor and there are no aluminum or copper alloy components exposed to condensation that are addressed by this item. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for steel piping and piping components (insulated or uninsulated) in the Auxiliary systems exposed to air - outdoor as addressed in items 3.3.1-78, 3.3.1-80 and 3.3.1-89. There are no tanks subject to aging management review that are within the scope of the Aboveground Metallic Tanks program in the Auxiliary systems. In addition to the Auxility systems, the Fire Protection program will manage cracking and loss of material for Aluminum Damper and louver housings and fixed louvers1 in the Bulk Civil Commodities exposed to Air-outdoor.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-133 (LR-ISG-2012-02)	Underground HDPE piping, piping components, and piping elements in an air-indoor uncontrolled or condensation (external) environment	Cracking, blistering, change in color due to water absorption	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There are no underground HDPE components subject to aging management review in the Auxiliary systems.
3.3.1-134 (LR-ISG-2012-02)	Steel, stainless steel, or copper alloy piping, piping components, and piping elements, and heat exchanger components exposed to a raw water environment (for nonsafety-related components not covered by NRC GL 89-13)	Loss of material due to general (steel and copper alloy only), pitting, crevice, and microbiologically influenced corrosion, fouling that leads to corrosion	Chapter XI.MI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will manage loss of material for steel, stainless steel and copper alloy piping, piping components, and piping elements in the Auxiliary systems exposed to raw water.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-135 (LR-ISG-2012-02)	Steel or stainless steel pump casings submerged in a waste water (internal and external) environment	Loss of material due to general (steel only), pitting, crevice, and microbiologically influenced corrosion	Chapter XI.MI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. Loss of material of stainless steel pump casings subject to aging management review in the Auxiliary systems that are submerged in a waste water (internal and external) environment are addressed in items 3.3.1-91 and 3.3.1-95 with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and in item 3.3.1-72 for gray cast iron with the Selective Leaching program.
3.3.1-136 (LR-ISG-2012-02)	Steel, stainless steel or aluminum fire water storage tanks exposed to air-indoor uncontrolled, air-outdoor, condensation, moist air, raw water, treated water	Loss of material due to general (steel only), pitting, crevice, and microbiologically influenced corrosion, fouling that leads to corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M27, "Fire Water System"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02) with a different component and program. This item is not used in the Auxiliary systems. PNPP does not have a fire water storage tank. The Water Chemistry and One Time Inspection programs will manage loss of material and cracking for aluminum, component and piping supports in the Bulk Civil Commodities exposed to treated water.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-137 (LR-ISG-2012-02)	Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, “Aboveground Metallic Tanks”) exposed to treated water, treated borated water	Loss of material due to general (steel only) pitting and crevice corrosion	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not applicable. There are no steel, stainless steel or aluminum tanks subject to aging management review in the Auxiliary systems that are within the scope of the Aboveground Metallic Tanks program.
3.3.1-138 (LR-ISG-2013-01)	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, lubricating oil, or fuel oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coating/linings.	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2013-01). The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program will manage loss of coating or lining integrity for metallic components in the Auxiliary systems with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, or fuel oil. There are no metallic piping, piping components, heat exchangers, tanks with internal coatings/linings subject to aging management exposed to treated borated water or lubricating oil.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-139 (LR-ISG-2013-01)	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leasds to corrosion	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2013-01). The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program will manage loss of material for metallic components with internal coatings/linings in the Auxiliary systems exposed to closed-cycle cooling water, raw water, or treated water. LR-ISG-2013-01 did not add NUREG-1801 rows for loss of material in fuel oil. However, the XI.M42 program includes management of loss of material in fuel oil. There are no metallic piping, piping components, heat exchangers, tanks with internal coatings/linings subject to aging management exposed to treated borated water or lubricating oil.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-140 (LR-ISG-2013-01)	Gray cast iron piping component with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2013-01). The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks will manage loss of material due to selective leaching for components with internal coatings/linings exposed to raw water. No coatings are identified for gray cast iron components in other environments.

Table 3.3.2-1
Auxiliary Systems – Auxiliary Building Ventilation System
Summary of Aging Management Evaluation

Table 3.3.2-1 - Auxiliary Building Ventilation

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Condenser	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
6	Condenser	Leakage boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408 (LR-ISG-2012-02)	3.3.1-134	A
7	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
8	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-1 - Auxiliary Building Ventilation									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
10	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
11	Filter plenum	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
12	Filter plenum	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
13	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
14	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
15	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A

Table 3.3.2-1 - Auxiliary Building Ventilation

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
16	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-2
Auxiliary Systems – Breathable Air
Summary of Aging Management Evaluation

Table 3.3.2-2 - Breathable Air System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Filter housing	Pressure boundary	Stainless steel	Air – dry (Int)	None	None	VII.J.AP-20	3.3.1-120	A
2	Filter housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
3	Flexible hose	Pressure boundary	Stainless steel	Air – dry (Int)	None	None	VII.J.AP-20	3.3.1-120	A
4	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
5	Piping	Pressure boundary	Stainless steel	Air – dry (Int)	None	None	VII.J.AP-20	3.3.1-120	A
6	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
7	Tank	Pressure boundary	Steel	Air – dry (Int)	None	None	VII.J.AP-4	3.3.1-121	C
8	Tank	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
9	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – dry (Int)	None	None	VII.J.AP-8	3.3.1-114	A
10	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
11	Valve body	Pressure boundary	Stainless steel	Air – dry (Int)	None	None	VII.J.AP-20	3.3.1-120	A
12	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-3
Auxiliary Systems – Building Heating
Summary of Aging Management Evaluation

Table 3.3.2-3 - Building Heating System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Heat exchanger (Area heater - Header)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
4	Heat exchanger (Area heater - Header)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
5	Heat exchanger (Area heater - Tube)	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
6	Heat exchanger (Area heater - Tube)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A
7	Heat exchanger (Ventilation heater - Header)	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C

Table 3.3.2-3 - Building Heating System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
8	Heat exchanger (Ventilation heater - Header)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A
9	Heat exchanger (Ventilation heater - Header)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Heat exchanger (Ventilation heater - Header)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
11	Heat exchanger (Ventilation heater - Tube)	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
12	Heat exchanger (Ventilation heater - Tube)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A
13	Orifice	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
14	Orifice	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
15	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-3 - Building Heating System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
16	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Cracking	Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	A, 328
17	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
18	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
19	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
20	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
21	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water >60°C (>140°F) (Int)	Cracking	Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	A
22	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water >60°C (>140°F) (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
23	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
24	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A

Table3.3.2-4
Auxiliary Systems – Combustible Gas Control
Summary of Aging Management Evaluation

Table3.3.2-4 - Combustible Gas Control System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Analyzer body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
2	Analyzer body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
3	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
7	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
8	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
9	Compressor housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C

Table3.3.2-4 - Combustible Gas Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
10	Compressor housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
11	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
12	Filter housing	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.F3.AP-127	3.3.1-97	A
13	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
14	Flexible hose	Pressure boundary	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
15	Flow element	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
16	Flow element	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
17	Heat exchanger (Channel)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	C
18	Heat exchanger (Channel)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
19	Heat exchanger (Channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
20	Heat exchanger (Channel)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	D

Table3.3.2-4 - Combustible Gas Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
21	Heat exchanger (Shell)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
22	Heat exchanger (Shell)	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
23	Heat exchanger (Shell)	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	C
24	Heat exchanger (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
25	Heat exchanger (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
26	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	C
27	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
28	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
29	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Reduction of heat transfer	Closed Treated Water Systems	VII.E3.AP-188	3.3.1-50	A

Table3.3.2-4 - Combustible Gas Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
30	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	C
31	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Lubricating oil (Ext)	Reduction of heat transfer	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-79	3.2.1-51	A
32	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-111	3.3.1-25	B
33	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Treated water (Int)	Reduction of heat transfer	Water Chemistry and One-Time Inspection	VII.A4.AP-139	3.3.1-17	B
34	Heat exchanger (Tubesheet)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	C
35	Heat exchanger (Tubesheet)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
36	Heat exchanger (Tubesheet)	Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
37	Heat exchanger (Tubesheet)	Pressure boundary	Stainless steel	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	C
38	Heat exchanger (Tubesheet)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-111	3.3.1-25	B
39	Moisture separator	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A

Table3.3.2-4 - Combustible Gas Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
40	Moisture separator	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
41	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
42	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
43	Orifice	Flow restriction, Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
44	Orifice	Flow restriction, Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
45	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
46	Piping	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.F3.AP-127	3.3.1-97	A
47	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
48	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
49	Piping	Pressure boundary	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A

Table3.3.2-4 - Combustible Gas Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
50	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
51	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
52	Piping	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
53	Piping	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.F3.AP-127	3.3.1-97	A
54	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
55	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
56	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
57	Piping	Structural integrity	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
58	Pump casing	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
59	Pump casing	Leakage boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.F3.AP-127	3.3.1-97	A

Table3.3.2-4 - Combustible Gas Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
60	Pump casing	Pressure boundary	CASS	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
61	Pump casing	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
62	Pump casing	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
63	Pump casing	Pressure boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.F3.AP-127	3.3.1-97	A
64	Recombiner housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	C
65	Recombiner housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
66	Screen	Filtration	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
67	Screen	Filtration	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
68	Sight glass	Pressure boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
69	Sight glass	Pressure boundary	Glass	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-14	3.3.1-117	A, 303
70	Sight glass	Pressure boundary	Glass	Gas (Int)	None	None	VII.J.AP-98	3.3.1-117	A

Table3.3.2-4 - Combustible Gas Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
71	Sight glass (Body)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
72	Sight glass (Body)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
73	Sight glass (Body)	Pressure boundary	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
74	Tank (oil reservoir)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
75	Tank (oil reservoir)	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.F3.AP-127	3.3.1-97	C
76	Valve body	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
77	Valve body	Pressure boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
78	Valve body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
79	Valve body	Pressure boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.F3.AP-127	3.3.1-97	A
80	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
81	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table3.3.2-4 - Combustible Gas Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
82	Valve body	Pressure boundary	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
83	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	A
84	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
85	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
86	Valve body	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
87	Valve body	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.F3.AP-127	3.3.1-97	A

Table 3.3.2-5
Auxiliary Systems – Computer Room HVAC
Summary of Aging Management Evaluation

Table 3.3.2-5 - Computer Room HVAC System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
2	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-6
Auxiliary Systems – Containment and Drywell Vacuum Relief
Summary of Aging Management Evaluation

Table 3.3.2-6 - Containment and Drywell Vacuum Relief System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
4	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
5	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
6	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
7	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	A
8	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
9	Piping	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of	VII.I.A-78	3.3.1-78	A

Table 3.3.2-6 - Containment and Drywell Vacuum Relief System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
						Mechanical Components			
10	Piping	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
11	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
12	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
13	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	A
14	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
15	Valve body	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A

Table 3.3.2-7
Auxiliary Systems – Containment Integrated Leak Rate Test
Summary of Aging Management Evaluation

Table 3.3.2-7 - Containment Integrated Leak Rate Test System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
4	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
5	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
6	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
7	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
8	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A

Table 3.3.2-7 - Containment Integrated Leak Rate Test System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Piping (Spectacle flange)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
10	Piping (Spectacle flange)	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
11	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
12	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
13	Valve body	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
14	Valve body	Structural integrity	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A

Table 3.3.2-8
Auxiliary Systems – Containment Vessel and Drywell Purge
Summary of Aging Management Evaluation

Table 3.3.2-8 - Containment Vessel and Drywell Purge System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
6	Filter housing	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
7	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	A
8	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
9	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-8 - Containment Vessel and Drywell Purge System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
10	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
11	Piping	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
12	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
13	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
14	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
15	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
16	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
17	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
18	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-8 - Containment Vessel and Drywell Purge System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
19	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
20	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
21	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
22	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
23	Valve body	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
24	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
25	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
26	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F3.A-10	3.3.1-78	C
27	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C

Table 3.3.2-8 - Containment Vessel and Drywell Purge System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
28	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-9
Auxiliary Systems – Containment Vessel Chilled Water
Summary of Aging Management Evaluation

Table 3.3.2-9 - Containment Vessel Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
4	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
5	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
6	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
7	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Filter housing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
9	Heat exchanger (Channel)	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C

Table 3.3.2-9 - Containment Vessel Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
10	Heat exchanger (Channel)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
11	Heat exchanger (Channel)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
12	Heat exchanger (Channel)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
13	Heat exchanger (Channel)	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	C
14	Heat exchanger (Shell)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
15	Heat exchanger (Shell)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-131	3.3.1-98	A
16	Heat exchanger (Ventilation cooling coil)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
17	Heat exchanger (Ventilation cooling coil)	Leakage boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	C

Table 3.3.2-9 - Containment Vessel Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
18	Heat exchanger (Ventilation cooling header)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
19	Heat exchanger (Ventilation cooling header)	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	C
20	Orifice	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
21	Orifice	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
22	Orifice	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
23	Orifice	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
24	Orifice	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
25	Piping	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-9 - Containment Vessel Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
26	Piping	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
27	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
28	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
29	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
30	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
31	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
32	Piping	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
33	Piping	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
34	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-9 - Containment Vessel Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
35	Piping	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
36	Piping	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
37	Pump casing	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
38	Pump casing	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	B
39	Pump casing	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
40	Pump casing	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	Selective Leaching	VII.C1.A-51	3.3.1-72	B, 333
41	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
42	Pump casing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
43	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A

Table 3.3.2-9 - Containment Vessel Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
44	Sight glass	Leakage boundary	Glass	Lubricating oil (Int)	None	None	VII.J.AP-15	3.3.1-117	A
45	Sight glass (Body)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
46	Sight glass (Body)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
47	Tank	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
48	Tank	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
49	Tank	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
50	Tank	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	C
51	Tank	Leakage boundary	Steel with internal coating/lining	Closed-cycle cooling water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-416 (LR-ISG-2013-01)	3.3.1-138	A

Table 3.3.2-9 - Containment Vessel Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
52	Tank	Leakage boundary	Steel with internal coating/lining	Closed-cycle cooling water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-414 (LR-ISG-2013-01)	3.3.1-139	A
53	Tank	Leakage boundary	Steel with internal coating/lining	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
54	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
55	Valve body	Leakage boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
56	Valve body	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
57	Valve body	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	B
58	Valve body	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
59	Valve body	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	Selective Leaching	VII.C1.A-51	3.3.1-72	B, 333

Table 3.3.2-9 - Containment Vessel Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
60	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
61	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
62	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
63	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
64	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
65	Valve body	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
66	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
67	Valve body	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A

Table 3.3.2-9 - Containment Vessel Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
68	Valve body	Pressure boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
69	Valve body	Pressure boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
70	Valve body	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
71	Valve body	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A

Table 3.3.2-10
Auxiliary Systems – Control and Computer Room Humidification
Summary of Aging Management Evaluation

Table 3.3.2-10 - Control and Computer Rooms Humidification System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Boiler	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
2	Boiler	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
3	Boiler	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
4	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	VII.E3.A-34	3.3.1-2	A
5	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
7	Distribution manifold	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
8	Distribution manifold	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
9	Distribution manifold	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
10	Humidifier	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A

Table 3.3.2-10 - Control and Computer Rooms Humidification System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Humidifier	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
12	Humidifier	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
13	Piping	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
14	Piping	Leakage boundary	Copper alloy <15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-140	3.3.1-22	B
15	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
16	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
17	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
18	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
19	Piping	Leakage boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A
20	Piping	Leakage boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A

Table 3.3.2-10 - Control and Computer Rooms Humidification System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
21	Piping	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1.A-08	3.3.1-90	A
22	Piping	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
23	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
24	Rupture disc	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
25	Rupture disc	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
26	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
27	Sight glass	Leakage boundary	Glass	Treated water (Int)	None	None	VII.J.AP-51	3.3.1-117	A
28	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
29	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Selective Leaching	VII.E3.AP-32	3.3.1-72	B
30	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-140	3.3.1-22	B
31	Strainer body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-10 - Control and Computer Rooms Humidification System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
32	Strainer body	Leakage boundary	Copper alloy <15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-140	3.3.1-22	B
33	Strainer body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
34	Strainer body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
35	Strainer body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
36	Strainer body (Cap & plug)	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
37	Strainer body (Cap & plug)	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Selective Leaching	VII.E3.AP-32	3.3.1-72	B
38	Strainer body (Cap & plug)	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-140	3.3.1-22	B
39	Trap body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
40	Trap body	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1.A-08	3.3.1-90	A
41	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-10 - Control and Computer Rooms Humidification System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
42	Valve body	Leakage boundary	Copper alloy <15% Zn	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	A
43	Valve body	Leakage boundary	Copper alloy <15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-140	3.3.1-22	B
44	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
45	Valve body	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Selective Leaching	VII.E3.AP-32	3.3.1-72	B
46	Valve body	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-140	3.3.1-22	B
47	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
48	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
49	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
50	Valve body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	V.D2.E-10	3.2.1-1	A
51	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-11
Auxiliary Systems – Control Complex Chilled Water
Summary of Aging Management Evaluation

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
4	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
7	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
8	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
9	Compressor housing	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Compressor housing	Pressure boundary	Gray cast iron	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
12	Filter housing	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
13	Heat exchanger (Channel)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
14	Heat exchanger (Channel)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
15	Heat exchanger (Channel)	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
16	Heat exchanger (Channel)	Pressure boundary	CASS	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
17	Heat exchanger (Channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
18	Heat exchanger (Channel)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
19	Heat exchanger (Channel)	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	C

Table 3.3.2-11 - Control Complex Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
20	Heat exchanger (Shell)	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
21	Heat exchanger (Shell)	Pressure boundary	Copper alloy >15% Zn	Gas (Int)	None	None	VII.J.AP-9	3.3.1-114	C
22	Heat exchanger (Shell)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
23	Heat exchanger (Shell)	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	C
24	Heat exchanger (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
25	Heat exchanger (Shell)	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	C
26	Heat exchanger (Shell)	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	C
27	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
28	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Reduction of heat transfer	Closed Treated Water Systems	VII.F1.AP-205	3.3.1-50	A

Table 3.3.2-11 - Control Complex Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
29	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Gas (Ext)	None	None	VII.J.AP-9	3.3.1-114	C
30	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
31	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-188	3.3.1-50	A
32	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	C
33	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Lubricating oil (Ext)	Reduction of heat transfer	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-79	3.2.1-51	A
34	Heat exchanger (Tubesheet)	Pressure boundary	CASS	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
35	Heat exchanger (Tubesheet)	Pressure boundary	CASS	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	C
36	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
37	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Gas (Ext)	None	None	VII.J.AP-6	3.3.1-121	C
38	Heat exchanger (Tubesheet)	Pressure boundary	Steel with internal coating/lini ng	Closed-cycle cooling water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-416 (LR-ISG-2013-01)	3.3.1-138	A
39	Heat exchanger (Tubesheet)	Pressure boundary	Steel with internal coating/lini ng	Closed-cycle cooling water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-414 (LR-ISG-2013-01)	3.3.1-139	A
40	Heat exchanger (Tubesheet)	Pressure boundary	Steel with internal coating/lini ng	Gas (Ext)	None	None	VII.J.AP-6	3.3.1-121	C
41	Heat exchanger (Ventilation cooling coil fin)	Heat transfer	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	C

Table 3.3.2-11 - Control Complex Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
42	Heat exchanger (Ventilation cooling coil fin)	Heat transfer	Copper alloy <15% Zn	Condensation (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 329
43	Heat exchanger (Ventilation cooling coil fin)	Heat transfer	Copper alloy <15% Zn, Solder coated	Condensation (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	F, 329
44	Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
45	Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Reduction of heat transfer	Closed Treated Water Systems	VII.F1.AP-205	3.3.1-50	A
46	Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	C

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
47	Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Condensation (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 329
48	Heat exchanger (Ventilation cooling coil tube)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
49	Heat exchanger (Ventilation cooling coil tube)	Leakage boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	C
50	Heat exchanger (Ventilation cooling header)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
51	Heat exchanger (Ventilation cooling header)	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	C
52	Heat exchanger (Ventilation cooling header)	Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A

Table 3.3.2-11 - Control Complex Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
53	Heat exchanger (Ventilation cooling header)	Pressure boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	C
54	Heat exchanger (Ventilation cooling header)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
55	Heat exchanger (Ventilation cooling header)	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	C
56	Orifice	Flow restrictio n, Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
57	Orifice	Flow restrictio n, Pressure boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
58	Orifice	Flow restrictio n, Pressure boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
59	Orifice	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
60	Orifice	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
61	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
62	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
63	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
64	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
65	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
66	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
67	Piping	Pressure boundary	Copper alloy <15% Zn	Gas (Int)	None	None	VII.J.AP-9	3.3.1-114	A

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
68	Piping	Pressure boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
69	Piping	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
70	Piping	Pressure boundary	Copper alloy >15% Zn	Gas (Int)	None	None	VII.J.AP-9	3.3.1-114	A
71	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
72	Piping	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
73	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
74	Piping	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
75	Piping	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
76	Piping	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
77	Piping	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A

Table 3.3.2-11 - Control Complex Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
78	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
79	Pump casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
80	Pump casing	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
81	Pump casing	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
82	Pump casing	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
83	Sight glass	Pressure boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
84	Sight glass	Pressure boundary	Glass	Gas (Int)	None	None	VII.J.AP-98	3.3.1-117	A
85	Sight glass	Pressure boundary	Glass	Lubricating oil (Int)	None	None	VII.J.AP-15	3.3.1-117	A
86	Sight glass (Body)	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
87	Sight glass (Body)	Pressure boundary	Copper alloy >15% Zn	Gas (Int)	None	None	VII.J.AP-9	3.3.1-114	A

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
88	Sight glass (Body)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
89	Sight glass (Body)	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
90	Strainer body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
91	Strainer body	Pressure boundary	Copper alloy >15% Zn	Gas (Int)	None	None	VII.J.AP-9	3.3.1-114	A
92	Tank	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
93	Tank	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
94	Tank	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
95	Tank	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	C

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
96	Tank	Pressure boundary	Steel with internal coating/lining	Closed-cycle cooling water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-416 (LR-ISG-2013-01)	3.3.1-138	A
97	Tank	Pressure boundary	Steel with internal coating/lining	Closed-cycle cooling water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-414 (LR-ISG-2013-01)	3.3.1-139	A
98	Tank	Pressure boundary	Steel with internal coating/lining	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
99	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
100	Valve body	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A
101	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
102	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A

Table 3.3.2-11 - Control Complex Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
103	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
104	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
105	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
106	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
107	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
108	Valve body	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
109	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
110	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
111	Valve body	Pressure boundary	Copper alloy >15% Zn	Gas (Int)	None	None	VII.J.AP-9	3.3.1-114	A

Table 3.3.2-11 - Control Complex Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
112	Valve body	Pressure boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
113	Valve body	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
114	Valve body	Pressure boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
115	Valve body	Pressure boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
116	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
117	Valve body	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
118	Valve body	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
119	Valve body	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
120	Valve body	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A

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Table 3.3.2-12
Auxiliary Systems – Control Rod Drive
Summary of Aging Management Evaluation

Table 3.3.2-12 - Control Rod Drive System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Accumulator (Cylinder)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
2	Accumulator (Cylinder)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
3	Accumulator (End cap)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
4	Accumulator (End cap)	Pressure boundary	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
5	Accumulator (End cap)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
6	Accumulator (Nitrogen cylinder)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
7	Accumulator (Nitrogen cylinder)	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
8	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A

Table 3.3.2-12 - Control Rod Drive System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
10	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
11	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
12	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
13	Filter housing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
14	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
15	Filter housing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
16	Filter housing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
17	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-12 - Control Rod Drive System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
18	Flexible hose	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
19	Flow restrictor	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
20	Flow restrictor	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
21	Heat exchanger (Channel)	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
22	Heat exchanger (Channel)	Leakage boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E1.AP-203	3.3.1-46	A
23	Heat exchanger (Channel)	Leakage boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	D
24	Heat exchanger (Channel)	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
25	Heat exchanger (Channel)	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
26	Heat exchanger (Channel)	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	D

Table 3.3.2-12 - Control Rod Drive System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
27	Heat exchanger (Shell)	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
28	Heat exchanger (Shell)	Leakage boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	C
29	Heat exchanger (Shell)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
30	Heat exchanger (Shell)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-131	3.3.1-98	A
31	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
32	Orifice	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408 (LR-ISG-2012-01)	3.3.1-126	A
33	Orifice	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
34	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
35	Piping	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	A

Table 3.3.2-12 - Control Rod Drive System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
36	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408 (LR-ISG-2012-01)	3.3.1-126	A
37	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
38	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
39	Piping	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
40	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
41	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
42	Piping	Pressure boundary	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
43	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Cracking	Water Chemistry and One-Time Inspection	VII.E3.AP-283	3.3.1-16	B
44	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
45	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B

Table 3.3.2-12 - Control Rod Drive System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
46	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
47	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
48	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
49	Piping	Structural integrity	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
50	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
51	Pump casing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
52	Pump casing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
53	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
54	Sight glass	Leakage boundary	Glass	Lubricating oil (Int)	None	None	VII.J.AP-15	3.3.1-117	A
55	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-12 - Control Rod Drive System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
56	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
57	Strainer body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
58	Strainer body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
59	Tank	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
60	Tank	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	C
61	Valve body	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
62	Valve body	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
63	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
64	Valve body	Leakage boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A

Table 3.3.2-12 - Control Rod Drive System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
65	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
66	Valve body	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	A
67	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408 (LR-ISG-2012-01)	3.3.1-126	A
68	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
69	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
70	Valve body	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
71	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
72	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
73	Valve body	Pressure boundary	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
74	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B

Table 3.3.2-12 - Control Rod Drive System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
75	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
76	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-13
Auxiliary Systems – Control Room HVAC and Emergency Recirculation
Summary of Aging Management Evaluation

Table 3.3.2-13 - Control Room HVAC and Emergency Recirculation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
6	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
7	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
8	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
9	Damper housing	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	C

Table 3.3.2-13 - Control Room HVAC and Emergency Recirculation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Damper housing	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-81	3.3.1-78	A
11	Duct	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	C
12	Duct	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-135	3.3.1-113	C
13	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
14	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
15	Duct	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	C
16	Duct	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-81	3.3.1-78	A
17	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A

Table 3.3.2-13 - Control Room HVAC and Emergency Recirculation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
18	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
19	Filter housing	Filtration	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	C
20	Filter housing	Filtration	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
21	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F1.AP-102	3.3.1-76	A
22	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F1.AP-102	3.3.1-76	A
23	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.AP-113	3.3.1-82	A
24	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1.AP-103	3.3.1-96	A, 332
25	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A

Table 3.3.2-13 - Control Room HVAC and Emergency Recirculation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
26	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
27	Heater housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
28	Heater housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
29	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	C
30	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
31	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
32	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A
33	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	C

Table 3.3.2-13 - Control Room HVAC and Emergency Recirculation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
34	Piping	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
35	Plenum	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
36	Plenum	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
37	Plenum	Pressure boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1.A-08	3.3.1-90	A
38	Valve body	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
39	Valve body	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A
40	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	C
41	Valve body	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

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Table 3.3.2-14
Auxiliary Systems – Controlled Access and Miscellaneous Equipment Areas HVAC
Summary of Aging Management Evaluation

Table 3.3.2-14 - Controlled Access and Miscellaneous Equipment Areas HVAC System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
4	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
5	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
6	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
7	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A

Table 3.3.2-14 - Controlled Access and Miscellaneous Equipment Areas HVAC System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
8	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
9	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	C
10	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
11	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	C
12	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-15a
Auxiliary Systems – Diesel Generator and Auxiliaries – Starting Air and Control Air
Summary of Aging Management Evaluation

Table 3.3.2-15a - Diesel Generator and Auxiliaries – Starting Air and Control Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
7	Filter housing	Pressure boundary	Aluminum	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-134	3.3.1-113	E, 309
8	Filter housing	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A
9	Filter housing	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309

Table 3.3.2-15a - Diesel Generator and Auxiliaries – Starting Air and Control Air Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
10	Filter housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
11	Flexible hose	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
12	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
13	Lubricator body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
14	Lubricator body	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
15	Manometer	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A
16	Manometer	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-135	3.3.1-113	A
17	Manometer (Glass)	Pressure boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
18	Manometer (Glass)	Pressure boundary	Glass	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-14	3.3.1-117	A, 303
19	Moisture separator	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-15a - Diesel Generator and Auxiliaries – Starting Air and Control Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
20	Moisture separator	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A
21	Orifice	Flow restriction, Pressure boundary	Aluminum	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-134	3.3.1-113	E, 309
22	Orifice	Flow restriction, Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A
23	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
24	Orifice	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A
25	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
26	Piping	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A

Table 3.3.2-15a - Diesel Generator and Auxiliaries – Starting Air and Control Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
27	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
28	Piping	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
29	Piping	Pressure boundary	Copper alloy <15% Zn	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-8	3.3.1-114	E, 309
30	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
31	Piping	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
32	Piping	Pressure boundary	Stainless Steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
33	Piping	Pressure boundary	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
34	Piping	Pressure boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A
35	Piping	Pressure boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309

Table 3.3.2-15a - Diesel Generator and Auxiliaries – Starting Air and Control Air Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
36	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
37	Piping	Pressure boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
38	Piping	Structural integrity	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309
39	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
40	Starting Air Motor Housing	Pressure boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309
41	Starting Air Motor Housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
42	Strainer body	Pressure boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309
43	Strainer body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
44	Tank (Accumulator)	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309

Table 3.3.2-15a - Diesel Generator and Auxiliaries – Starting Air and Control Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
45	Tank (Accumulator)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
46	Tank (Air receiver)	Pressure boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309
47	Tank (Air receiver)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
48	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
49	Valve body	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A
50	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
51	Valve body	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
52	Valve body	Pressure boundary	Aluminum	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-134	3.3.1-113	E, 309
53	Valve body	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A

Table 3.3.2-15a - Diesel Generator and Auxiliaries – Starting Air and Control Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
54	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-8	3.3.1-114	E, 309
55	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
56	Valve body	Pressure boundary	Gray cast iron	Air – dry (Int)	None	None	VII.J.AP-4	3.3.1-121	A, 331
57	Valve body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 331
58	Valve body	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
59	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
60	Valve body	Pressure boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A
61	Valve body	Pressure boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309
62	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	C, 311

Table 3.3.2-15a - Diesel Generator and Auxiliaries – Starting Air and Control Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
63	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
64	Valve body	Pressure boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
65	Valve body	Pressure boundary	Zinc	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-13	3.3.1-116	F, 338
66	Valve body	Pressure boundary	Zinc	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-13	3.3.1-116	F, 334
67	Valve body	Structural integrity	Copper alloy >15% Zn	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-8	3.3.1-114	E, 309
68	Valve body	Structural integrity	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
69	Valve body	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
70	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-15b
Auxiliary Systems - Diesel Generator and Auxiliaries – Fuel Oil
Summary of Aging Management Evaluation

Table 3.3.2-15b - Diesel Generator and Auxiliaries – Fuel Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.I.AP-241	3.3.1-109	A
6	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-242	3.3.1-14	A
7	Drip pan	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Eductor	Pressure boundary	Copper alloy <15% Zn	Fuel oil (Ext)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-132	3.3.1-69	A

Table 3.3.2-15b - Diesel Generator and Auxiliaries – Fuel Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Eductor	Pressure boundary	Copper alloy <15% Zn	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-132	3.3.1-69	A
10	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
11	Filter housing	Pressure boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
12	Flame arrestor	Pressure boundary	Aluminum	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.AP-256	3.3.1-81	A
13	Flame arrestor	Pressure boundary	Aluminum	Air – outdoor (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.AP-256	3.3.1-81	A, 318
14	Flame arrestor	Pressure boundary	Gray cast iron	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.H1.A-24	3.3.1-80	A
15	Flame arrestor	Pressure boundary	Gray cast iron	Air – outdoor (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.H1.A-24	3.3.1-80	A, 318
16	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-15b - Diesel Generator and Auxiliaries – Fuel Oil

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
17	Flexible hose	Pressure boundary	Stainless steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-136	3.3.1-71	A
18	Orifice	Flow restriction, Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
19	Orifice	Flow restriction, Pressure boundary	Copper alloy >15% Zn	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-132	3.3.1-69	A
20	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
21	Orifice	Flow restriction, Pressure boundary	Stainless steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-136	3.3.1-71	A
22	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
23	Piping	Leakage boundary	Stainless steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-136	3.3.1-71	A
24	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-15b - Diesel Generator and Auxiliaries – Fuel Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
25	Piping	Leakage boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
26	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
27	Piping	Pressure boundary	Stainless steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-136	3.3.1-71	A
28	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
29	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
30	Piping	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.H1.A-24	3.3.1-80	A
31	Piping	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.H1.A-24	3.3.1-80	A, 318

Table 3.3.2-15b - Diesel Generator and Auxiliaries – Fuel Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
32	Piping	Pressure boundary	Steel	Fuel oil (Ext)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
33	Piping	Pressure boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
34	Piping	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.H1.AP-198 (LR-ISG-2011-03)	3.3.1-106	A, 325
35	Pump casing	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
36	Pump casing	Pressure boundary	Gray cast iron	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
37	Pump casing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
38	Pump casing	Pressure boundary	Stainless steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-136	3.3.1-71	A
39	Pump casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-15b - Diesel Generator and Auxiliaries – Fuel Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
40	Pump casing	Pressure boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
41	Strainer body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
42	Strainer body	Pressure boundary	Gray cast iron	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
43	Strainer body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
44	Strainer body	Pressure boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
45	Strainer element	Filtration	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
46	Tank	Pressure boundary	Steel with internal coating/lining	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-15b - Diesel Generator and Auxiliaries – Fuel Oil

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
47	Tank	Pressure boundary	Steel with internal coating/lining	Fuel oil (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.H2.A-416 (LR-ISG-2013-01)	3.3.1-138	A
48	Tank	Pressure boundary	Steel with internal coating/lining	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A, 302
49	Tank	Pressure boundary	Steel with internal coating/lining	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.H1.AP-198 (LR-ISG-2011-03)	3.3.1-106	C, 325
50	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
51	Valve body	Leakage boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
52	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
53	Valve body	Pressure boundary	Copper alloy >15% Zn	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-132	3.3.1-69	A

Table 3.3.2-15b - Diesel Generator and Auxiliaries – Fuel Oil

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
54	Valve body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
55	Valve body	Pressure boundary	Gray cast iron	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
56	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
57	Valve body	Pressure boundary	Stainless steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-136	3.3.1-71	A
58	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
59	Valve body	Pressure boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A

Table 3.3.2-15c
Auxiliary Systems - Diesel Generator and Auxiliaries – Cooling Water
Summary of Aging Management Evaluation

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Flexible connection	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
6	Flexible connection	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	A
7	Flexible connection	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Flexible connection	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	A

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Heat exchanger (Channel)	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Heat exchanger (Channel)	Pressure boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
11	Heat exchanger (Channel)	Pressure boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	D
12	Heat exchanger (Channel)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
13	Heat exchanger (Channel)	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
14	Heat exchanger (Channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
15	Heat exchanger (Channel)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
16	Heat exchanger (Channel)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-183	3.3.1-38	A
17	Heat exchanger (Shell)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
18	Heat exchanger (Shell)	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-138	3.3.1-100	C
19	Heat exchanger (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
20	Heat exchanger (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	C
21	Heat exchanger (Shell)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
22	Heat exchanger (Shell)	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-131	3.3.1-98	A
23	Heat exchanger (Tube fin)	Heat transfer	Aluminum	Air – indoor, uncontrolled (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 335
24	Heat exchanger (Tube fin)	Heat transfer	Aluminum	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-162	3.3.1-99	C
25	Heat exchanger (Tube fin)	Heat transfer	Aluminum	Lubricating oil (Ext)	Reduction of heat transfer	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-154	3.3.1-101	A

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
26	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 335
27	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A
28	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	A
29	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-133	3.3.1-99	C
30	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Lubricating oil (Ext)	Reduction of heat transfer	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-78	3.2.1-51	A
31	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 335
32	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
33	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A
34	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Ext)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	D
35	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	D
36	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Ext)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	A
37	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	A
38	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-133	3.3.1-99	C
39	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Lubricating oil (Ext)	Reduction of heat transfer	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-78	3.2.1-51	A

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
40	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-179	3.3.1-38	A
41	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Selective Leaching	VII.C1.A-66	3.3.1-72	B
42	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Reduction of heat transfer	Open-Cycle Cooling Water System	VII.C1.A-72	3.3.1-42	A
43	Heat exchanger (Tubesheet)	Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A
44	Heat exchanger (Tubesheet)	Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Ext)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	D
45	Heat exchanger (Tubesheet)	Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-179	3.3.1-38	A
46	Heat exchanger (Tubesheet)	Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Selective Leaching	VII.C1.A-66	3.3.1-72	B
47	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
48	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
49	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-131	3.3.1-98	A
50	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-183	3.3.1-38	A
51	Heater housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
52	Heater housing	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
53	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
54	Orifice	Flow restriction, Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
55	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
56	Orifice	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
57	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
58	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	A
59	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
60	Piping	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
61	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
62	Piping	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	A
63	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
64	Pump casing	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
65	Pump casing	Pressure boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	A
66	Pump casing	Pressure boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	B

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
67	Sight glass	Pressure boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
68	Sight glass	Pressure boundary	Glass	Closed-cycle cooling water (Int)	None	None	VII.J.AP-166	3.3.1-117	A
69	Sight glass (Body)	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
70	Sight glass (Body)	Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A
71	Sight glass (Body)	Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	B
72	Tank	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
73	Tank	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	A
74	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
75	Valve body	Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A

Table 3.3.2-15c - Diesel Generator and Auxiliaries – Cooling Water

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
76	Valve body	Pressure boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	B
77	Valve body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
78	Valve body	Pressure boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	A
79	Valve body	Pressure boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	B
80	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
81	Valve body	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
82	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
83	Valve body	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.H2.AP-202	3.3.1-45	A

Table 3.3.2-15d
Auxiliary Systems - Diesel Generator and Auxiliaries - Lubricating Oil
Summary of Aging Management Evaluation

Table 3.3.2-15d - Diesel Generator and Auxiliaries - Lubricating Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
6	Filter housing	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
7	Heater housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Heater housing	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A

Table 3.3.2-15d - Diesel Generator and Auxiliaries - Lubricating Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
10	Orifice	Flow restriction, Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-138	3.3.1-100	A
11	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
12	Piping	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C1.AP-138	3.3.1-100	A
13	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
14	Piping	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
15	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
16	Piping	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-138	3.3.1-100	A
17	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-15d - Diesel Generator and Auxiliaries - Lubricating Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
18	Piping	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
19	Pump casing	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
20	Pump casing	Pressure boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
21	Pump casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
22	Pump casing	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
23	Sight glass	Pressure boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
24	Sight glass	Pressure boundary	Glass	Lubricating oil (Int)	None	None	VII.J.AP-15	3.3.1-117	A
25	Sight glass (Body)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
26	Sight glass (Body)	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-138	3.3.1-100	A

Table 3.3.2-15d - Diesel Generator and Auxiliaries - Lubricating Oil

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
27	Sight glass (Body)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
28	Sight glass (Body)	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
29	Strainer body	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A
30	Strainer body	Pressure boundary	Aluminum	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-162	3.3.1-99	A
31	Strainer body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
32	Strainer body	Pressure boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-133	3.3.1-99	A
33	Strainer body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
34	Strainer body	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
35	Strainer element	Filtration	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-138	3.3.1-100	A

Table 3.3.2-15d - Diesel Generator and Auxiliaries - Lubricating Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
36	Tank	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
37	Tank	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	C
38	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
39	Valve body	Pressure boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-133	3.3.1-99	A
40	Valve body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
41	Valve body	Pressure boundary	Gray cast iron	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
42	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
43	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-138	3.3.1-100	A
44	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-15d - Diesel Generator and Auxiliaries - Lubricating Oil									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
45	Valve body	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A

Table 3.3.2-15e
Auxiliary Systems - Diesel Generator and Auxiliaries – Air Intake and Exhaust
Summary of Aging Management Evaluation

Table 3.3.2-15e - Diesel Generator and Auxiliaries – Air Intake and Exhaust									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Structural integrity	Steel	Air – outdoor (Ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	A
4	Bolting	Structural integrity	Steel	Air – outdoor (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A
5	Filter element	Filtration	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VIII.I.SP-86	3.4.1-58	A
6	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
7	Filter housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
8	Filter housing	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.H1.A-24	3.3.1-80	A, 318

Table 3.3.2-15e - Diesel Generator and Auxiliaries – Air Intake and Exhaust									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Filter housing	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A
10	Filter housing	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-127	3.3.1-97	A
11	Flexible connection	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
12	Flexible connection	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Cracking	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-128	3.3.1-83	A
13	Flexible connection	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Cumulative fatigue damage	TLAA	N/A	N/A	H, 337
14	Flexible connection	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
15	Flexible connection	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
16	Flexible connection	Pressure boundary	Steel	Diesel exhaust (Int)	Cumulative fatigue damage	TLAA	N/A	N/A	H, 337

Table 3.3.2-15e - Diesel Generator and Auxiliaries – Air Intake and Exhaust									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
17	Flexible connection	Pressure boundary	Steel	Diesel exhaust (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
18	Heat exchanger (Turbocharger Channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	VII.E3.A-34	3.3.1-2	C
19	Heat exchanger (Turbocharger Channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
20	Heat exchanger (Turbocharger Channel)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
21	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
22	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
23	Piping	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-138	3.3.1-100	A
24	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-15e - Diesel Generator and Auxiliaries – Air Intake and Exhaust									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
25	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
26	Piping	Pressure boundary	Steel	Diesel exhaust (Int)	Cumulative fatigue damage	TLAA	N/A	N/A	H, 337
27	Piping	Pressure boundary	Steel	Diesel exhaust (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
28	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
29	Piping	Structural integrity	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A
30	Piping	Structural integrity	Steel	Diesel exhaust (Int)	Cumulative fatigue damage	TLAA	N/A	N/A	H, 337
31	Piping	Structural integrity	Steel	Diesel exhaust (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A

Table 3.3.2-15e - Diesel Generator and Auxiliaries – Air Intake and Exhaust

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
32	Silencer housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
33	Silencer housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
34	Turbocharger housing (Compressor)	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A
35	Turbocharger housing (Compressor)	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-135	3.3.1-113	A
36	Turbocharger housing (Compressor)	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-34	3.3.1-2	A
37	Turbocharger housing (Compressor)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
38	Turbocharger housing (Compressor)	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C

Table 3.3.2-15e - Diesel Generator and Auxiliaries – Air Intake and Exhaust									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
39	Turbocharger housing (Compressor)	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
40	Turbocharger housing (Turbine)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
41	Turbocharger housing (Turbine)	Pressure boundary	Steel	Diesel exhaust (Int)	Cumulative fatigue damage	TLAA	N/A	N/A	H, 337
42	Turbocharger housing (Turbine)	Pressure boundary	Steel	Diesel exhaust (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
43	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
44	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VIII.I.SP-86	3.4.1-58	A
45	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-138	3.3.1-100	A

Table 3.3.2-16
Auxiliary Systems – Diesel Generator Building Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-16 - Diesel Generator Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A
5	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F4.A-10	3.3.1-78	A
6	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
7	Damper housing	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A

Table 3.3.2-16 - Diesel Generator Building Ventilation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
8	Damper housing	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	C
9	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F4.A-10	3.3.1-78	A
10	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
11	Duct	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A
12	Duct	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	C
13	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F4.A-10	3.3.1-78	A

Table 3.3.2-16 - Diesel Generator Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
14	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
15	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F4.AP-102	3.3.1-76	A
16	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F4.AP-102	3.3.1-76	A
17	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F4.AP-113	3.3.1-82	A
18	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F4.AP-103	3.3.1-96	A, 332

Table 3.3.2-17
Auxiliary Systems – ECC Pump Room Cooling
Summary of Aging Management Evaluation

Table 3.3.2-17 - ECC Pump Room Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Air handling unit housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-123	3.3.1-120	A
2	Air handling unit housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
3	Air handling unit housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
4	Air handling unit housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-18
Auxiliary Systems – Emergency Closed Cooling
Summary of Aging Management Evaluation

Table 3.3.2-18 - Emergency Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
7	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Flexible hose	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
9	Heat exchanger (Channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-41	3.3.1-80	A
10	Heat exchanger (Channel)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-183	3.3.1-38	A

Table 3.3.2-18 - Emergency Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Heat exchanger (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-41	3.3.1-80	A
12	Heat exchanger (Shell)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
13	Heat exchanger (Shell)	Structural integrity	Steel	Air – indoor, uncontrolled (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-29	3.2.1-44	E, 307
14	Heat exchanger (Shell)	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
15	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
16	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-188	3.3.1-50	A
17	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	C
18	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Raw water (Int)	Reduction of heat transfer	Open-Cycle Cooling Water System	VII.C1.AP-187	3.3.1-42	A
19	Heat exchanger (Tubesheet)	Pressure boundary	Steel with stainless steel cladding	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A

Table 3.3.2-18 - Emergency Closed Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
20	Heat exchanger (Tubesheet)	Pressure boundary	Steel with stainless steel cladding	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	C
21	Heat Exchanger (Ventilation cooling coil fin)	Heat transfer	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 326
22	Heat Exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 326
23	Heat Exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
24	Heat Exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	A
25	Heat Exchanger (Ventilation cooling header)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-41	3.3.1-80	A
26	Heat Exchanger (Ventilation cooling header)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
27	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-18 - Emergency Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
28	Orifice	Flow restriction, Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
29	Orifice	Flow restriction, Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
30	Orifice	Flow restriction, Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
31	Orifice	Flow restriction, Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
32	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
33	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
34	Piping	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
35	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
36	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
37	Piping	Leakage boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Table 3.3.2-18 - Emergency Closed Cooling System									
38	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
39	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
40	Piping	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
41	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
42	Piping	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
43	Piping	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408 (LR-ISG-2012-01)	3.3.1-126	A, 306
44	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.C1.A-409 (LR-ISG-2012-01)	3.3.1-126	A
45	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
46	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
47	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-29	3.2.1-44	E, 307
48	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-18 - Emergency Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
49	Pump casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
50	Pump casing	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
51	Pump casing	Structural integrity	Steel	Air – indoor, uncontrolled (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	V.D2.E-29	3.2.1-44	E, 307
52	Pump casing	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
53	Seal cooler (RHR pump - Shell & cover)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-41	3.3.1-80	A
54	Seal cooler (RHR pump - Shell & cover)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
55	Seal cooler (RHR pump - Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
56	Seal cooler (RHR pump - Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-188	3.3.1-50	A
57	Seal cooler (RHR pump - Tube)	Heat transfer, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-111	3.3.1-25	B

Table 3.3.2-18 - Emergency Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
58	Seal cooler (RHR pump - Tube)	Heat transfer, Pressure boundary	Stainless steel	Treated water (Int)	Reduction of heat transfer	Water Chemistry and One-Time Inspection	VII.E3.AP-139	3.3.1-27	B
59	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
60	Sight glass	Leakage boundary	Glass	Closed-cycle cooling water (Int)	None	None	VII.J.AP-166	3.3.1-117	A
61	Sight glass (Body)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
62	Sight glass (Body)	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
63	Tank	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
64	Tank	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
65	Tank	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
66	Tank	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
67	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
68	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A

Table 3.3.2-18 - Emergency Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
69	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
70	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
71	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
72	Valve body	Leakage boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
73	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
74	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
75	Valve body	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
76	Valve body	Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
77	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
78	Valve body	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
79	Valve body	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408 (LR-ISG-2012-01)	3.3.1-126	A, 306

Table 3.3.2-18 - Emergency Closed Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
80	Valve body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.C1.A-409 (LR-ISG-2012-01)	3.3.1-126	A
81	Valve body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A

Table 3.3.2-19
Auxiliary Systems – Emergency Closed Cooling Pump Area HVAC
Summary of Aging Management Evaluation

Table 3.3.2-19 - Emergency Closed Cooling Pump Area HVAC System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Air handling unit housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
2	Air handling unit housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
6	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
7	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A

Table 3.3.2-19 - Emergency Closed Cooling Pump Area HVAC System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
8	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
9	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
10	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
11	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A
12	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A
13	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-113	3.3.1-82	A
14	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-103	3.3.1-96	A, 332

Table 3.3.2-20
Auxiliary Systems – Emergency Service Water
Summary of Aging Management Evaluation

Table 3.3.2-20 - Emergency Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
3	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
5	Bolting	Pressure boundary	Steel	Raw water (Ext)	Loss of material	Bolting Integrity	VII.C1.AP-183	3.3.1-38	E
6	Bolting	Pressure boundary	Steel	Raw water (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-264	3.3.1-15	A
7	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.I.AP-241	3.3.1-109	A
8	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-242	3.3.1-14	A
9	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
10	Flexible hose	Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A

Table 3.3.2-20 - Emergency Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Heat exchanger (Pump motor cooler tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C1.AP-133	3.3.1-99	C
12	Heat exchanger (Pump motor cooler tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Lubricating oil (Ext)	Reduction of heat transfer	Lubricating Oil Analysis and One-Time Inspection	V.D2.EP-78	3.2.1-51	A
13	Heat exchanger (Pump motor cooler tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-179	3.3.1-38	A
14	Heat exchanger (Pump motor cooler tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Raw water (Int)	Reduction of heat transfer	Open-Cycle Cooling Water System	VII.C1.A-72	3.3.1-42	A
15	Heat exchanger (Pump motor oil reservoir)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
16	Heat exchanger (Pump motor oil reservoir)	Pressure boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-131	3.3.1-98	A
17	Heat exchanger (Ventilation cooling coil fin)	Heat transfer	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	C

Table 3.3.2-20 - Emergency Service Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
18	Heat exchanger (Ventilation cooling coil fin)	Heat transfer	Copper alloy <15% Zn	Condensation (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 326
19	Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	A
20	Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Condensation (Ext)	Reduction of heat transfer	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	N/A	N/A	G, 326
21	Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-179	3.3.1-38	A
22	Heat exchanger (Ventilation cooling coil tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Raw water (Int)	Reduction of heat transfer	Open-Cycle Cooling Water System	VII.C1.A-72	3.3.1-42	A
23	Heat Exchanger (Ventilation cooling header)	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	C

Table 3.3.2-20 - Emergency Service Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
24	Heat Exchanger (Ventilation cooling header)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-183	3.3.1-38	A
25	Orifice	Flow restriction, Pressure boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
26	Orifice	Flow restriction, Pressure boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
27	Orifice	Flow restriction, Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
28	Piping	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
29	Piping	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
30	Piping	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
31	Piping	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A

Table 3.3.2-20 - Emergency Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
32	Piping	Leakage boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
33	Piping	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
34	Piping	Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-196	3.3.1-36	A
35	Piping	Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Selective Leaching	VII.C1.A-47	3.3.1-72	B
36	Piping	Pressure boundary	Stainless steel	Air – dry (Int)	None	None	VII.J.AP-20	3.3.1-120	A
37	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
38	Piping	Pressure boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
39	Piping	Pressure boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
40	Piping	Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A

Table 3.3.2-20 - Emergency Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
41	Piping	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
42	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.C1.A-409 (LR-ISG-2012-01)	3.3.1-126	A
43	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-400 (LR-ISG-2012-02)	3.3.1-127	E
44	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
45	Piping	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.C1.AP-198	3.3.1-106	A
46	Pump casing	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
47	Pump casing	Leakage boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
48	Pump casing	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
49	Pump casing	Pressure boundary	Steel	Raw water (Ext)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A

Table 3.3.2-20 - Emergency Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
50	Pump casing	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
51	Pump casing (Suction bell)	Pressure boundary	CASS	Raw water (Ext)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
52	Pump casing (Suction bell)	Pressure boundary	CASS	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
53	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
54	Sight glass	Leakage boundary	Glass	Raw water (Int)	None	None	VII.J.AP-50	3.3.1-117	A
55	Sight glass	Pressure boundary	Glass	Air – dry (Int)	None	None	VII.J.AP-48	3.3.1-117	A
56	Sight glass	Pressure boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
57	Sight glass (Body)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
58	Sight glass (Body)	Leakage boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
59	Sight glass (Body)	Pressure boundary	Copper alloy >15% Zn	Air – dry (Int)	None	None	VII.J.AP-8	3.3.1-114	A

Table 3.3.2-20 - Emergency Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
60	Sight glass (Body)	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
61	Strainer body	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
62	Strainer body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
63	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
64	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
65	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
66	Valve body	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
67	Valve body	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
68	Valve body	Leakage boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A

Table 3.3.2-20 - Emergency Service Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
69	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – dry (Int)	None	None	VII.J.AP-8	3.3.1-114	A
70	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
71	Valve body	Pressure boundary	Stainless steel	Air – dry (Int)	None	None	VII.J.AP-20	3.3.1-120	A
72	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
73	Valve body	Pressure boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
74	Valve body	Pressure boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
75	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C1.AP-138	3.3.1-100	A
76	Valve body	Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
77	Valve body	Pressure boundary	Steel	Air – dry (Int)	None	None	VII.J.AP-4	3.3.1-121	A

Table 3.3.2-20 - Emergency Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
78	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
79	Valve body	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
80	Valve body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.C1.A-409 (LR-ISG-2012-01)	3.3.1-126	A
81	Valve body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-400 (LR-ISG-2012-02)	3.3.1-127	E
82	Valve body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A

Table 3.3.2-21
Auxiliary Systems – Emergency Service Water Pump House Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-21 - Emergency Service Water Pumphouse Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
4	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
5	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
6	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
7	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A

Table 3.3.2-21 - Emergency Service Water Pumphouse Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
8	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-22
Auxiliary Systems – Emergency Service Water Screen Wash
Summary of Aging Management Evaluation

Table 3.3.2-22 - Emergency Service Water Screen Wash System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Raw water (Ext)	Loss of material	Bolting Integrity	VII.C1.AP-183	3.3.1-38	E
4	Bolting	Pressure boundary	Steel	Raw water (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-264	3.3.1-15	A
5	Nozzle	Flow control	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
6	Nozzle	Flow control	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
7	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Piping	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
9	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
10	Piping	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C1.AP-138	3.3.1-100	A
11	Piping	Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A

Table 3.3.2-22 - Emergency Service Water Screen Wash System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
12	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
13	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
14	Pump casing (Bowl)	Pressure boundary	Stainless steel	Raw water (Ext)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
15	Pump casing (Bowl)	Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
16	Pump casing (Column)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
17	Pump casing (Column)	Pressure boundary	Steel	Raw water (Ext)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
18	Pump casing (Column)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
19	Strainer body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
20	Strainer body	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A
21	Strainer body	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.C1.A-51	3.3.1-72	B
22	Traveling screen	Filtration	Stainless steel	Raw water (Ext)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A

Table 3.3.2-22 - Emergency Service Water Screen Wash System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
23	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
24	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C1.AP-138	3.3.1-100	A
25	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
26	Valve body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-194 (LR-ISG-2013-01)	3.3.1-37	A

Table 3.3.2-23
Auxiliary Systems - Feedwater Zinc Injection
Summary of Aging Management Evaluation

Table 3.3.2-23 - Feedwater Zinc Injection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
2	Filter housing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
3	Heat exchanger (Channel)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
4	Heat exchanger (Channel)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-111	3.3.1-25	B
5	Heat exchanger (Shell)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
6	Heat exchanger (Shell)	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
7	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
9	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B

Table 3.3.2-23 - Feedwater Zinc Injection System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
10	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
11	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
12	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	A

Table 3.3.2-24
Auxiliary Systems – Fire Protection
Summary of Aging Management Evaluation

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Pressure boundary	Steel	Raw water (Ext)	Loss of material	Bolting Integrity	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	E
6	Bolting	Pressure boundary	Steel	Raw water (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-264	3.3.1-15	A
7	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.I.AP-241	3.3.1-109	A
8	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-242	3.3.1-14	A
9	Flame arrestor	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-135	3.3.1-113	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Flame arrestor	Pressure boundary	Aluminum	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.AP-256	3.3.1-81	A
11	Flame arrestor	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A
12	Flame arrestor	Pressure boundary	Copper alloy >15% Zn	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.AP-159	3.3.1-81	A
13	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
14	Flexible hose	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Cracking	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-128	3.3.1-83	A
15	Flexible hose	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Cumulative fatigue damage	TLAA	N/A	N/A	H, 337
16	Flexible hose	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
17	Foam chamber (Discharge outlet)	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A
18	Foam chamber (Discharge outlet)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	C
19	Heat exchanger (Diesel fire pump HX channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
20	Heat exchanger (Diesel fire pump HX channel)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	C
21	Heat exchanger (Diesel fire pump HX shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
22	Heat exchanger (Diesel fire pump HX shell)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
23	Heat exchanger (Diesel fire pump HX tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A

Table 3.3.2-24 - Fire Protection System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
24	Heat exchanger (Diesel fire pump HX tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Ext)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	A
25	Heat exchanger (Diesel fire pump HX tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	C
26	Heat exchanger (Diesel fire pump HX tube)	Heat transfer, Pressure boundary	Copper alloy <15% Zn	Raw water (Int)	Reduction of heat transfer	Fire Water System	VII.C1.A-72	3.3.1-42	E, 304
27	Muffler	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
28	Muffler	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Cracking	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-128	3.3.1-83	A
29	Muffler	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Cumulative fatigue damage	TLAA	N/A	N/A	H, 337
30	Muffler	Pressure boundary	Stainless steel	Diesel exhaust (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
31	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
32	Orifice	Flow restriction, Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-55 (LR-ISG-2012-02)	3.3.1-66	A
33	Orifice	Flow restriction, Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
34	Orifice	Flow restriction, Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
35	Orifice	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
36	Orifice	Leakage boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
37	Piping	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 331

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
38	Piping	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Protection	VII.G.A-400 (LR-ISG-2012-02)	3.3.1-127	A, 331
39	Piping	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A, 331
40	Piping	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B, 331
41	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
42	Piping	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-55 (LR-ISG-2012-02)	3.3.1-66	A
43	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
44	Piping	Leakage boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
45	Piping	Leakage boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-400 (LR-ISG-2012-02)	3.3.1-127	E
46	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
47	Piping	Pressure boundary	Copper alloy <15% Zn	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.G.AP-132	3.3.1-69	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
48	Piping	Pressure boundary	Copper alloy <15% Zn	Gas (Int)	None	None	VII.J.AP-9	3.3.1-114	A
49	Piping	Pressure boundary	Fiberglass	Raw water (Int)	Change in mechanical properties, Blistering	Fire Water System	VII.C1.AP-238	3.3.1-30x	E
50	Piping	Pressure boundary	Fiberglass	Soil (Ext)	Change in mechanical properties, Blistering	Buried and Underground Piping and Tanks	VII.C1.AP-176	3.3.1-104	A
51	Piping	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 331
52	Piping	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 331
53	Piping	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Int)	Loss of material	Fire Water System	VII.G.A-404 (LR-ISG-2012-02)	3.3.1-131	A, 331
54	Piping	Pressure boundary	Gray cast iron	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A, 331
55	Piping	Pressure boundary	Gray cast iron	Air – outdoor (Int)	Loss of material	Fire Water System	VII.G.A-404 (LR-ISG-2012-02)	3.3.1-131	A, 331

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
56	Piping	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Protection	VII.G.A-400 (LR-ISG-2012-02)	3.3.1-127	A, 331
57	Piping	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A, 331
58	Piping	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	A, 331
59	Piping	Pressure boundary	Gray cast iron	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.G.AP-198 (LR-ISG-2011-03)	3.3.1-106	A, 331
60	Piping	Pressure boundary	Gray cast iron	Soil (Ext)	Loss of material	Selective Leaching	VII.G.A-02	3.3.1-72	A, 331
61	Piping	Pressure boundary	Gray cast iron with internal coating/lining	Raw water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.G.A-416 (LR-ISG-2013-01)	3.3.1-138	A, 331
62	Piping	Pressure boundary	Gray cast iron with internal coating/lining	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.A-414 (LR-ISG-2013-01)	3.3.1-139	A, 331
63	Piping	Pressure boundary	Gray cast iron with internal coating/lining	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	A, 331

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
64	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
65	Piping	Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-55 (LR-ISG-2012-02)	3.3.1-66	A
66	Piping	Pressure boundary	Stainless steel	Soil (Ext)	Cracking	Buried and Underground Piping and Tanks	VII.C3.A-401 (LR-ISG-2012-02)	3.3.1-128	E
67	Piping	Pressure boundary	Stainless steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.C1.AP-137 (LR-ISG-2011-03)	3.3.1-107	A
68	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Flow blockage	Fire Water System	VII.G.A-404 (LR-ISG-2012-02)	3.3.1-131	A
69	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
70	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
71	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Fire Water System	VII.G.A-404 (LR-ISG-2012-02)	3.3.1-131	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
72	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
73	Piping	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A
74	Piping	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	Fire Protection	VII.I.A-78	3.3.1-78	E
75	Piping	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Fire Water System	VII.G.A-404 (LR-ISG-2012-02)	3.3.1-131	A
76	Piping	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
77	Piping	Pressure boundary	Steel	Diesel exhaust (Int)	Cumulative fatigue damage	TLAA	N/A	N/A	H, 337
78	Piping	Pressure boundary	Steel	Diesel exhaust (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
79	Piping	Pressure boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
80	Piping	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
81	Piping	Pressure boundary	Steel	Raw water (Int)	Flow blockage	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
82	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
83	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-400 (LR-ISG-2012-02)	3.3.1-127	E
84	Piping	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.G.AP-198 (LR-ISG-2011-03)	3.3.1-106	A
85	Piping	Pressure boundary, Flow restriction	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
86	Piping	Pressure boundary, Flow restriction	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	A
87	Pump casing	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
88	Pump casing	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A

Table 3.3.2-24 - Fire Protection System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
89	Pump casing	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B
90	Pump casing	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
91	Pump casing	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
92	Pump casing	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B
93	Pump casing (Column)	Pressure boundary	Steel	Raw water (Ext)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
94	Pump casing (Column)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
95	Pump casing (Diesel fire pump fuel oil)	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
96	Pump casing (Diesel fire pump fuel oil)	Pressure boundary	Copper alloy >15% Zn	Fuel oil (Int)	Cracking	Fuel Oil Chemistry and One-Time Inspection	N/A	N/A	H, 336
97	Pump casing (Diesel fire pump fuel oil)	Pressure boundary	Copper alloy >15% Zn	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.G.AP-132	3.3.1-69	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
98	Pump casing (Diesel fire pump fuel oil)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
99	Pump casing (Diesel fire pump fuel oil)	Pressure boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
100	Pump casing (Diesel fire pump jacket water)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
101	Pump casing (Diesel fire pump jacket water)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
102	Pump casing (Suction bell)	Pressure boundary	Gray cast iron with internal coating/lining	Raw water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.G.A-416 (LR-ISG-2013-01)	3.3.1-138	A
103	Pump casing (Suction bell)	Pressure boundary	Gray cast iron with internal coating/lining	Raw water (Ext)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
104	Pump casing (Suction bell)	Pressure boundary	Gray cast iron with internal coating/lining	Raw water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.G.A-414 (LR-ISG-2013-01)	3.3.1-139	A
105	Pump casing (Suction bell)	Pressure boundary	Gray cast iron with internal coating/lining	Raw water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.G.A-415 (LR-ISG-2013-01)	3.3.1-140	A
106	Pump casing (Suction bell)	Pressure boundary	Gray cast iron with internal coating/lining	Raw water (Ext)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B
107	Pump casing (Suction strainer element)	Filtration	Copper alloy <15% Zn	Raw water (Ext)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	A
108	Pump casing (Suction strainer element)	Filtration	Stainless steel	Raw water (Ext)	Loss of material	Fire Water System	VII.G.A-55 (LR-ISG-2012-02)	3.3.1-66	A, 330
109	Sight glass	Leakage boundary	Polymers	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-268	3.3.1-119	F, 310
110	Sight glass	Leakage boundary	Polymers	Raw water (Int)	None	None	VII.J.AP-269	3.3.1-119	F, 310

Table 3.3.2-24 - Fire Protection System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
111	Sight glass	Pressure boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
112	Sight glass	Pressure boundary	Glass	Raw water (Int)	None	None	VII.J.AP-50	3.3.1-117	A
113	Sight glass	Pressure boundary	Polymers	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-268	3.3.1-119	F, 310
114	Sight glass	Pressure boundary	Polymers	Raw water (Int)	None	None	VII.J.AP-269	3.3.1-119	F, 310
115	Sight glass (Body)	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
116	Sight glass (Body)	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
117	Sight glass (Body)	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B
118	Sight glass (Body)	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
119	Sight glass (Body)	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
120	Sight glass (Body)	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B

Table 3.3.2-24 - Fire Protection System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
121	Sight glass (Body)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
122	Sight glass (Body)	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
123	Spray nozzle	Direct flow	Copper alloy >15% Zn	Air – outdoor (Int)	Loss of material	Fire Water System	VII.G.A-404 (LR-ISG-2012-02)	3.3.1-131	A
124	Spray nozzle	Direct flow	Copper alloy >15% Zn	Air – outdoor (Ext)	Loss of material	Fire Water System	VII.I.AP-159	3.3.1-81	E
125	Sprinkler head	Direct flow	Copper alloy <15% Zn	Air – indoor, uncontrolled (Int)	Flow blockage	Fire Water System	VII.G.A-403 (LR-ISG-2012-02)	3.3.1-130	A
126	Sprinkler head	Direct flow	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
127	Sprinkler head	Direct flow	Copper alloy <15% Zn	Raw water (Int)	Flow blockage	Fire Water System	VII.G.A-403 (LR-ISG-2012-02)	3.3.1-130	A
128	Sprinkler head	Direct flow	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-403 (LR-ISG-2012-02)	3.3.1-130	A
129	Strainer body	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
130	Strainer body	Pressure boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	A

Table 3.3.2-24 - Fire Protection System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
131	Strainer body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
132	Strainer body	Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	A
133	Strainer body	Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-47	3.3.1-72	B
134	Strainer body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
135	Strainer body	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
136	Strainer body	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B
137	Strainer body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
138	Strainer body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
139	Tank	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
140	Tank	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	C
141	Tank (CO2)	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.G.A-405 (LR-ISG-2012-02)	3.3.1-132	A
142	Tank (CO2)	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	C
143	Tank (Fuel oil)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
144	Tank (Fuel oil)	Pressure boundary	Steel	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.H1.AP-105	3.3.1-70	A
145	Tank (Pressure maintenance)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
146	Tank (Pressure maintenance)	Leakage boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	C
147	Tank (Retarding chamber)	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
148	Tank (Retarding chamber)	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
149	Tank (Retarding chamber)	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B
150	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
151	Valve body	Leakage boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	A
152	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
153	Valve body	Leakage boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	A
154	Valve body	Leakage boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-47	3.3.1-72	B
155	Valve body	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
156	Valve body	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
157	Valve body	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
158	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
159	Valve body	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-55 (LR-ISG-2012-02)	3.3.1-66	A
160	Valve body	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
161	Valve body	Pressure boundary	Copper alloy <15% Zn	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.AP-159	3.3.1-81	A
162	Valve body	Pressure boundary	Copper alloy <15% Zn	Gas (Int)	None	None	VII.J.AP-9	3.3.1-114	A
163	Valve body	Pressure boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	A
164	Valve body	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
165	Valve body	Pressure boundary	Copper alloy >15% Zn	Fuel oil (Int)	Cracking	Fuel Oil Chemistry and One-Time Inspection	N/A	N/A	H, 336
166	Valve body	Pressure boundary	Copper alloy >15% Zn	Fuel oil (Int)	Loss of material	Fuel Oil Chemistry and One-Time Inspection	VII.G.AP-132	3.3.1-69	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
167	Valve body	Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Fire Water System	VII.G.AP-197 (LR-ISG-2012-02)	3.3.1-64	A
168	Valve body	Pressure boundary	Copper alloy >15% Zn	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-47	3.3.1-72	B
169	Valve body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
170	Valve body	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 331
171	Valve body	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
172	Valve body	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A, 331
173	Valve body	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	A, 331
174	Valve body	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B
175	Valve body	Pressure boundary	Gray cast iron	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.G.AP-198 (LR-ISG-2011-03)	3.3.1-106	A
176	Valve body	Pressure boundary	Gray cast iron	Soil (Ext)	Loss of material	Selective Leaching	VII.G.A-02	3.3.1-72	B

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
177	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
178	Valve body	Pressure boundary	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
179	Valve body	Pressure boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.G.AP-138	3.3.1-100	A
180	Valve body	Pressure boundary	Stainless steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-55 (LR-ISG-2012-02)	3.3.1-66	A
181	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
182	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
183	Valve body	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	Fire Protection	VII.I.A-78	3.3.1-78	E
184	Valve body	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
185	Valve body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A
186	Valve body (Hydrant)	Pressure boundary	Gray cast iron	Air – outdoor (Ext)	Loss of material	Fire Water System	VII.G.AP-149	3.3.1-63	A
187	Valve body (Hydrant)	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Fire Water System	VII.G.A-33 (LR-ISG-2012-02)	3.3.1-64	A

Table 3.3.2-24 - Fire Protection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
188	Valve body (Hydrant)	Pressure boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	B
189	Valve body (Hydrant)	Pressure boundary	Gray cast iron	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.G.AP-198 (LR-ISG-2011-03)	3.3.1-106	A
190	Valve body (Hydrant)	Pressure boundary	Gray cast iron	Soil (Ext)	Loss of material	Selective Leaching	VII.G.A-02	3.3.1-72	B

Table 3.3.2-25
Auxiliary Systems – Floor and Equipment Drains
Summary of Aging Management Evaluation

Table 3.3.2-25 - Floor and Equipment Drains System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Drain pan	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
4	Drain pan	Leakage boundary	Stainless steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
5	Drain pan	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
6	Drain pan	Leakage boundary	Steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-25 - Floor and Equipment Drains System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
7	Drains	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Drains	Leakage boundary	Stainless steel	Concrete (Ext)	None	None	VII.J.AP-19	3.3.1-120	A
9	Drains	Leakage boundary	Stainless steel	Fuel oil (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-136	3.3.1-71	E, 327
10	Drains	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-138	3.3.1-100	E, 327
11	Drains	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
12	Drains	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
13	Drains	Leakage boundary	Steel	Concrete (Ext)	None	None	VII.J.AP-282	3.3.1-112	A

Table 3.3.2-25 - Floor and Equipment Drains System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
14	Drains	Leakage boundary	Steel	Fuel oil (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-105	3.3.1-70	E, 327
15	Drains	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-127	3.3.1-97	E, 327
16	Drains	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
17	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
18	Piping	Leakage boundary	Stainless steel	Concrete (Ext)	None	None	VII.J.AP-19	3.3.1-120	A
19	Piping	Leakage boundary	Stainless steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A

Table 3.3.2-25 - Floor and Equipment Drains System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
20	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
21	Piping	Leakage boundary	Steel	Concrete (Ext)	None	None	VII.J.AP-282	3.3.1-112	A
22	Piping	Leakage boundary	Steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
23	Piping	Pressure Boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
24	Piping	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
25	Piping	Pressure boundary	Steel	Concrete (Ext)	None	None	VII.J.AP-282	3.3.1-112	A
26	Piping	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.H1.AP-198 (LR-ISG-2011-03)	3.3.1-106	A

Table 3.3.2-25 - Floor and Equipment Drains System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
27	Piping	Pressure Boundary	Steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
28	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
29	Pump casing	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
30	Strainer body	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.H2.A-23	3.3.1-89	E, 322
31	Strainer body	Pressure boundary	Steel	Concrete (Ext)	None	None	VII.J.AP-282	3.3.1-112	A
32	Strainer Element	Filtration	Copper alloy <15% Zn	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.AP-159	3.3.1-81	A

Table 3.3.2-25 - Floor and Equipment Drains System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
33	Tank (Drain receiver)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
34	Tank (Drain receiver)	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
35	Valve body	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
36	Valve body	Leakage boundary	Gray cast iron	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
37	Valve body	Leakage boundary	Gray cast iron	Waste Water (Int)	Loss of material	Selective Leaching	VII.E5.A-407 (LR-ISG-2012-02)	3.3.1-72	B
38	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-25 - Floor and Equipment Drains System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
39	Valve body	Leakage boundary	Stainless steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
40	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
41	Valve body	Leakage boundary	Steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-26
Auxiliary Systems – Fuel Handling Area Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-26 - Fuel Handling Area Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
6	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-26 - Fuel Handling Area Ventilation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
7	Damper housing	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
8	Duct	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	C
9	Duct	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-135	3.3.1-113	C
10	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
11	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
12	Duct	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A

Table 3.3.2-26 - Fuel Handling Area Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
13	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
14	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
15	Filter housing	Filtration	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-123	3.3.1-120	A
16	Filter housing	Filtration	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
17	Filter plenum	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
18	Filter plenum	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-26 - Fuel Handling Area Ventilation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
19	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A
20	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A
21	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-113	3.3.1-82	A
22	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-103	3.3.1-96	A, 332
23	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
24	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-26 - Fuel Handling Area Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
25	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	C
26	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
27	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
28	Piping	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A
29	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	C
30	Piping	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
31	Valve Body	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-26 - Fuel Handling Area Ventilation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
32	Valve Body	Pressure boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A
33	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
34	Valve body	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-27
Auxiliary Systems – Fuel Storage and Fuel Pool Cooling and Cleanup
Summary of Aging Management Evaluation

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
3	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
6	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
7	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
8	Bolting	Structural support	Stainless steel	Treated water (Ext)	Loss of material	Bolting Integrity	VII.A4.AP-110	3.3.1-25	E, 324
9	Bolting	Structural support	Stainless steel	Treated water (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-267	3.3.1-15	A
10	Drain pan	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Drain pan	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
12	Drain pan	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
13	Drain pan	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
14	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
15	Filter housing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
16	Filter-demin housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
17	Filter-demin housing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
18	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
19	Flexible hose	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
20	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
21	Flexible hose	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
22	Flow element	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
23	Flow element	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
24	Flow element	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
25	Flow element	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
26	Fuel storage rack (Defective fuel)	Structural support	Aluminum	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-130	3.3.1-25	D
27	Fuel storage rack (Spent fuel)	Structural support	Aluminum	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-130	3.3.1-25	D

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
28	Heat exchanger (Channel cover)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
29	Heat exchanger (Channel cover)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	D
30	Heat exchanger (Channel)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
31	Heat exchanger (Channel)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-111	3.3.1-25	B
32	Heat exchanger (Shell)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
33	Heat exchanger (Shell)	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.A4.AP-189	3.3.1-46	A
34	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
35	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Reduction of heat transfer	Closed Treated Water Systems	VII.C2.AP-188	3.3.1-50	A
36	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-111	3.3.1-25	B

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
37	Heat exchanger (Tube)	Heat transfer, Pressure boundary	Stainless steel	Treated water (Int)	Reduction of heat transfer	Water Chemistry and One-Time Inspection	VII.A4.AP-139	3.3.1-17	B
38	Heat exchanger (Tubesheet)	Pressure boundary	Stainless steel	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
39	Heat exchanger (Tubesheet)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-111	3.3.1-25	B
40	Neutron absorber	Absorb neutrons	Boral	Treated water (Ext)	Change in dimension	Monitoring of Neutron-Absorbing Materials Other than Boraflex	VII.A2.AP-236	3.3.1-102	A
41	Neutron absorber	Absorb neutrons	Boral	Treated water (Ext)	Loss of material	Monitoring of Neutron-Absorbing Materials Other than Boraflex	VII.A2.AP-236	3.3.1-102	A
42	Neutron absorber	Absorb neutrons	Boral	Treated water (Ext)	Reduction of neutron absorption	Monitoring of Neutron-Absorbing Materials Other than Boraflex	VII.A2.AP-236	3.3.1-102	A
43	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
44	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
45	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
46	Orifice	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
47	Orifice	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
48	Orifice	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
49	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
50	Piping	Leakage boundary	Stainless steel	Concrete (Ext)	None	None	VII.J.AP-19	3.3.1-120	A
51	Piping	Leakage boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
52	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
53	Piping	Leakage boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B, 320
54	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B, 320
55	Piping	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
56	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
57	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
58	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
59	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
60	Piping	Pressure boundary	Stainless steel	Concrete (Ext)	None	None	VII.J.AP-19	3.3.1-120	A
61	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
62	Piping	Pressure boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
63	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
64	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
65	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
66	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
67	Pump casing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
68	Pump casing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
69	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
70	Pump casing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
71	Pump casing	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
72	Pump casing	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
73	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
74	Sight glass	Leakage boundary	Glass	Treated water (Int)	None	None	VII.J.AP-51	3.3.1-117	A
75	Sight glass (Body)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
76	Sight glass (Body)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
77	Tank	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
78	Tank	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	D
79	Tank	Leakage boundary	Steel with internal coating/lining	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
80	Tank	Leakage boundary	Steel with internal coating/lining	Treated water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.A4.A-416 (LR-ISG-2013-01)	3.3.1-138	A
81	Tank	Leakage boundary	Steel with internal coating/lining	Treated water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.A4.A-414 (LR-ISG-2013-01)	3.3.1-139	A
82	Tank	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
83	Tank	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	D

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
84	Valve body	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
85	Valve body	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
86	Valve body	Leakage boundary	CASS	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
87	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
88	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
89	Valve body	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
90	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
91	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
92	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
93	Valve body	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
94	Valve body	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
95	Valve body	Pressure boundary	CASS	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
96	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
97	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
98	Valve body	Pressure boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
99	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-27 - Fuel Storage and Fuel Pool Cooling and Cleanup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
100	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
101	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
102	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-28
Auxiliary Systems – Hydrogen Water Chemistry
Summary of Aging Management Evaluation

Table 3.3.2-28 - Hydrogen Water Chemistry System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Flow element	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
2	Flow element	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
3	Flow element	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
4	Flow element	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
5	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
6	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
7	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
8	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
9	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-28 - Hydrogen Water Chemistry System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
11	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
12	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B

Table 3.3.2-29
Auxiliary Systems – Inclined Fuel Transfer System
Summary of Aging Management Evaluation

Table 3.3.2-29 - Inclined Fuel Transfer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bellows (Transfer tube)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
2	Bellows (Transfer tube)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
3	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
7	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Filter housing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	A
9	Fuel transfer tube	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-29 - Inclined Fuel Transfer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Fuel transfer tube	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
11	Fuel transfer tube	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
12	Fuel transfer tube	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
13	Fuel transfer tube	Structural support	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-123	3.3.1-120	A
14	Fuel transfer tube	Structural support	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
15	Fuel transfer tube	Structural support	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
16	Fuel transfer tube	Structural support	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	B
17	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
18	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	A

Table 3.3.2-29 - Inclined Fuel Transfer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
19	Piping	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
20	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-123	3.3.1-120	A
21	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
22	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
23	Piping	Structural support	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
24	Piping	Structural support	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	A
25	Pump casing	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
26	Pump casing	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Selective Leaching	VII.A4.AP-32	3.3.1-72	B
27	Pump casing	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-140	3.3.1-22	A
28	Pump casing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	B
29	Pump casing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	A

Table 3.3.2-29 - Inclined Fuel Transfer System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
30	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	B
31	Sight glass	Leakage boundary	Glass	Treated water (Int)	None	None	VII.J.AP-51	3.3.1-117	B
32	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
33	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Selective Leaching	VII.A4.AP-32	3.3.1-72	B
34	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-140	3.3.1-22	A
35	Tank (Accumulator)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
36	Tank (Accumulator)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	A
37	Tank (Accumulator)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	B
38	Tank (Accumulator)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
39	Tank (Sump)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
40	Tank (Sump)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	D
41	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-29 - Inclined Fuel Transfer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
42	Valve body	Leakage boundary	Copper alloy <15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-140	3.3.1-22	B
43	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
44	Valve body	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Selective Leaching	VII.A4.AP-32	3.3.1-72	B
45	Valve body	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-140	3.3.1-22	B
46	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
47	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
48	Valve body	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
49	Valve body	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
50	Valve body	Pressure boundary	CASS	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
51	Valve body	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
52	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-29 - Inclined Fuel Transfer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
53	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
54	Valve body	Structural support	CASS	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
55	Valve body	Structural support	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
56	Valve body	Structural support	CASS	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
57	Valve body	Structural support	CASS	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A

Table 3.3.2-30
Auxiliary Systems – Industrial Waste Disposal
Summary of Aging Management Evaluation

Table 3.3.2-30 - Industrial Waste Disposal System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A, 315
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A, 315
3	Piping	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.H1.A-24	3.3.1-80	A
4	Piping	Pressure boundary	Steel	Air – outdoor (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.H1.A-24	3.3.1-80	A, 318
5	Piping	Pressure boundary	Steel	Concrete (Ext)	None	None	VII.J.AP-282	3.3.1-112	A
6	Piping	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.H1.AP-198 (LR-ISG-2011-03)	3.3.1-106	A
7	Piping	Pressure boundary	Steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A, 314
8	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 317

Table 3.3.2-30 - Industrial Waste Disposal System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Valve body	Pressure boundary	Steel	Waste Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A, 317

Table 3.3.2-31
Auxiliary Systems – Intermediate Building Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-31 - Intermediate Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
4	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
5	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
6	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
7	Filter plenum	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
8	Filter plenum	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-31 - Intermediate Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
10	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
11	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
12	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-32
Auxiliary Systems – Leak Detection
Summary of Aging Management Evaluation

Table 3.3.2-32 - Leakage Detection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
6	Flexible hose	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
7	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B

Table 3.3.2-32 - Leakage Detection System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Piping	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-280	3.3.1-95	A
11	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
12	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
13	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
14	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
15	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
16	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
17	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A

Table 3.3.2-32 - Leakage Detection System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
18	Sight glass	Leakage boundary	Glass	Treated water (Int)	None	None	VII.J.AP-51	3.3.1-117	A
19	Sight glass (Body)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
20	Sight glass (Body)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
21	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
22	Valve body	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.EP-61	3.2.1-48	A
23	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
24	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
25	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-32 - Leakage Detection System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
26	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
27	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
28	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
29	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
30	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
31	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-33
Auxiliary Systems – Liquid Radwaste Disposal
Summary of Aging Management Evaluation

Table 3.3.2-33 Liquid Radwaste Disposal System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
6	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
7	Piping	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A

Table 3.3.2-33 Liquid Radwaste Disposal System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
8	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
9	Piping	Leakage boundary	Steel	Concrete (Ext)	None	None	VII.J.AP-282	3.3.1-112	A
10	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
11	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
12	Piping	Leakage boundary	Steel with internal coating/lining	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
13	Piping	Leakage boundary	Steel with internal coating/lining	Treated water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.E5.A-414 (LR-ISG-2013-01)	3.3.1-139	A, 321
14	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-33 Liquid Radwaste Disposal System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
15	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
16	Pump casing	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
17	Pump casing	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
18	Tank	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
19	Tank	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	D
20	Valve body	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
21	Valve body	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
22	Valve body	Leakage boundary	CASS	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
23	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-33 Liquid Radwaste Disposal System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
24	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
25	Valve body	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
26	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
27	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
28	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
29	Valve body	Leakage boundary	Steel with internal coating/lining	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-33 Liquid Radwaste Disposal System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
30	Valve body	Leakage boundary	Steel with internal coating/lining	Treated water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.E5.A-414 (LR-ISG-2013-01)	3.3.1-139	A, 321
31	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
32	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
33	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
34	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-34
Auxiliary Systems – Liquid Radwaste Sumps
Summary of Aging Management Evaluation

Table 3.3.2-34 - Liquid Radwaste Sumps System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Orifice	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
6	Orifice	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
7	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Piping	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A

Table 3.3.2-34 - Liquid Radwaste Sumps System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
11	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
12	Piping	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
13	Pump casing	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
14	Pump casing	Leakage boundary	Gray cast iron	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
15	Pump casing	Leakage boundary	Gray cast iron	Waste water (Int)	Loss of material	Selective Leaching	VII.E5.A-407 (LR-ISG-2012-02)	3.3.1-72	B
16	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-34 - Liquid Radwaste Sumps System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
17	Pump casing	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
18	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
19	Valve body	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
20	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
21	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
22	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
23	Valve body	Pressure boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A

Table 3.3.2-34 - Liquid Radwaste Sumps System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
24	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
25	Valve body	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-35
Auxiliary Systems – MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust
Summary of Aging Management Evaluation

Table 3.3.2-35 - MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
4	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
5	Duct	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	C
6	Duct	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-135	3.3.1-113	C
7	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A

Table 3.3.2-35 - MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
8	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
9	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
10	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
11	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F1.AP-102	3.3.1-76	A
12	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F1.AP-102	3.3.1-76	A
13	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.AP-113	3.3.1-82	A

Table 3.3.2-35 - MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
14	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1.AP-103	3.3.1-96	A, 332
15	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
16	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
17	Heater housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A
18	Heater housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
19	Plenum	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F1.A-10	3.3.1-78	A

Table 3.3.2-35 - MCC Switchgear and Miscellaneous Electrical Area HVAC, and Battery Room Exhaust System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
20	Plenum	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-36
Auxiliary Systems – Miscellaneous Area Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-36 - Miscellaneous Area Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
4	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
5	Duct	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A, 323
6	Duct	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A, 323

Table 3.3.2-36 - Miscellaneous Area Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
7	Duct	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-113	3.3.1-82	A, 323
8	Duct	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-103	3.3.1-96	A, 332
9	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
10	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
11	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
12	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-37
Auxiliary Systems – Miscellaneous Electrical Areas Smoke Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-37 Miscellaneous Electrical Areas Smoke Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
4	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
5	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
6	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-37 Miscellaneous Electrical Areas Smoke Ventilation System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
7	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
8	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
9	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A
10	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A
11	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-113	3.3.1-82	A
12	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-103	3.3.1-96	A, 332

Table 3.3.2-38
Auxiliary Systems – Miscellaneous Sump
Summary of Aging Management Evaluation

Table 3.3.2-38 - Miscellaneous Sumps System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – outdoor (Ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – outdoor (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A
3	Piping	Leakage boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A
4	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-39
Auxiliary Systems – Nitrogen Supply
Summary of Aging Management Evaluation

Table 3.3.2-39 - Nitrogen Supply System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
1	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
2	Piping	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
3	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
4	Piping	Structural integrity	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
5	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
6	Piping	Structural integrity	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
7	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Valve body	Pressure boundary	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
9	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
10	Valve body	Structural integrity	Stainless steel	Gas (Int)	None	None	VII.J.AP-22	3.3.1-120	A
11	Valve body	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-39 - Nitrogen Supply System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
12	Valve body	Structural integrity	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A

Table 3.3.2-40
Auxiliary Systems – Nuclear Closed Cooling
Summary of Aging Management Evaluation

Table 3.3.2-40 - Nuclear Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Heat exchanger (Air compr jacket)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
6	Heat exchanger (Air compr jacket)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
7	Heat exchanger (Channel)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Heat exchanger (Channel)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A

Table 3.3.2-40 - Nuclear Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Heat exchanger (Channel)	Leakage boundary	Steel with internal coating/lining	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Heat exchanger (Channel)	Leakage boundary	Steel with internal coating/lining	Raw water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-416 (LR-ISG-2013-01)	3.3.1-138	A
11	Heat exchanger (Channel)	Leakage boundary	Steel with internal coating/lining	Raw water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-414 (LR-ISG-2013-01)	3.3.1-139	A
12	Heat exchanger (Header)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
13	Heat exchanger (Header)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
14	Heat exchanger (Plate)	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
15	Heat exchanger (Plate)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Ext)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A

Table 3.3.2-40 - Nuclear Closed Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
16	Heat exchanger (Plate)	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	C
17	Heat exchanger (Shell)	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 331
18	Heat exchanger (Shell)	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A, 331
19	Heat exchanger (Shell)	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	C, 331
20	Heat exchanger (Shell)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
21	Heat exchanger (Shell)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
22	Heat exchanger (Tube)	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
23	Heat exchanger (Tube)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
24	Heat exchanger (Tube)	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Ext)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	C

Table 3.3.2-40 - Nuclear Closed Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
25	Heat exchanger (Tube)	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
26	Heat exchanger (Tube)	Leakage boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
27	Heat exchanger (Tube)	Leakage boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	D
28	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
29	Orifice	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
30	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
31	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A, 319
32	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
33	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A, 319

Table 3.3.2-40 - Nuclear Closed Cooling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
34	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
35	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
36	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
37	Piping	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
38	Pump casing	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
39	Pump casing	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
40	Pump casing	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	B
41	Strainer body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
42	Strainer body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A

Table 3.3.2-40 - Nuclear Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
43	Tank	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
44	Tank	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
45	Tank	Leakage boundary	Steel with internal coating/lining	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
46	Tank	Leakage boundary	Steel with internal coating/lining	Closed-cycle cooling water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-416 (LR-ISG-2013-01)	3.3.1-138	A
47	Tank	Leakage boundary	Steel with internal coating/lining	Closed-cycle cooling water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-414 (LR-ISG-2013-01)	3.3.1-139	A
48	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
49	Valve body	Leakage boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A

Table 3.3.2-40 - Nuclear Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
50	Valve body	Leakage boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	B
51	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
52	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
53	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
54	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
55	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
56	Valve body	Pressure boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
57	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
58	Valve body	Pressure boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A

Table 3.3.2-41
Auxiliary Systems – Offgas Building Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-41 - Offgas Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	A
6	Bolting	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A
7	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
8	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-41 - Offgas Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
10	Duct	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
11	Duct	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-78	3.3.1-78	A
12	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
13	Fan housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
14	Filter plenum	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A

Table 3.3.2-41 - Offgas Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
15	Filter plenum	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
16	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A
17	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Hardening and loss of strength	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-102	3.3.1-76	A
18	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-113	3.3.1-82	A
19	Flexible connection	Pressure boundary	Elastomers	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-103	3.3.1-96	A, 332
20	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A

Table 3.3.2-41 - Offgas Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
21	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
22	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
23	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
24	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
25	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-42
Auxiliary Systems – Penetration Electrical
Summary of Aging Management Evaluation
Table 3.3.2-4

Table 3.3.2-42 - Penetration Electrical System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
No Components Subject to Aging Management review									

Table 3.3.2-43
Auxiliary Systems – Penetration Pressurization
Summary of Aging Management Evaluation

Table 3.3.2-43 - Penetration Pressurization System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Flexible hose	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
6	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
7	Orifice	Flow restriction, Pressure boundary	Copper alloy >15% Zn	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-8	3.3.1-114	E, 309
8	Orifice	Flow restriction, Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
9	Piping	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
10	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
11	Piping	Pressure boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309

Table 3.3.2-43 - Penetration Pressurization System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
12	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
13	Piping	Structural integrity	Copper alloy <15% Zn	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-8	3.3.1-114	E, 309
14	Piping	Structural integrity	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
15	Piping	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
16	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
17	Piping	Structural integrity	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309
18	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
19	Tank	Pressure boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309
20	Tank	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
21	Valve body	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
22	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
23	Valve body	Pressure boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309

Table 3.3.2-43 - Penetration Pressurization System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
24	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
25	Valve body	Structural integrity	Copper alloy <15% Zn	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-8	3.3.1-114	E, 309
26	Valve body	Structural integrity	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
27	Valve body	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
28	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-44
Auxiliary Systems – Plant Foundation Underdrain
Summary of Aging Management Evaluation

Table 3.3.2-44 - Plant Foundation Underdrain System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.I.AP-241	3.3.1-109	A
2	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-242	3.3.1-14	A
3	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408 (LR-ISG-2012-02)	3.3.1-134	A
4	Piping	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.C1.AP-198	3.3.1-106	A

Table 3.3.2-45
Auxiliary Systems – Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring
Summary of Aging Management Evaluation

Table 3.3.2-45 - Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
7	Detector housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Detector housing	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
9	Detector housing	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A

Table 3.3.2-45 - Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Detector housing	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
11	Detector housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
12	Detector housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
13	Filter housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
14	Filter housing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
15	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
16	Flexible hose	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
17	Flexible hose	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
18	Flexible hose	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
19	Flow straightener	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-45 - Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
20	Flow straightener	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
21	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
22	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
23	Piping	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
24	Piping	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
25	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
26	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
27	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
28	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
29	Pump casing	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
30	Pump casing	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A

Table 3.3.2-45 - Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
31	Pump casing	Leakage boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.AP-196	3.3.1-36	A
32	Pump casing	Leakage boundary	Copper alloy <15% Zn	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	A
33	Pump casing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
34	Pump casing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
35	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
36	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
37	Valve body	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Open-Cycle Cooling Water System	VII.C1.A-54	3.3.1-40	A
38	Valve body	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
39	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
40	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-45 - Plant Radiation Monitoring and Process Monitoring, and Post Accident Radiation Monitoring System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
41	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
42	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-46
Auxiliary Systems – Post Accident Sampling
Summary of Aging Management Evaluation

Table 3.3.2-46 - Post Accident Sampling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Heat exchanger (Sample cooler channel)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
4	Heat exchanger (Sample cooler channel)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-111	3.3.1-25	B
5	Heat exchanger (Sample cooler shell)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
6	Heat exchanger (Sample cooler shell)	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	A
7	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B

Table 3.3.2-46 - Post Accident Sampling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Piping	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
10	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	C
11	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
12	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
13	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
14	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	C
15	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
16	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
17	Pump casing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-46 - Post Accident Sampling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
18	Pump casing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
19	Pump casing	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
20	Sample panel (housing)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
21	Sample panel (housing)	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
22	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
23	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
24	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B

Table 3.3.2-46 - Post Accident Sampling System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
25	Valve body	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
26	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	C
27	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
28	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
29	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
30	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	C
31	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
32	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-47
Auxiliary Systems – Potable Water Supply
Summary of Aging Management Evaluation

Table 3.3.2-47 - Potable Water Supply System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Eyewash station	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
4	Eyewash station	Leakage boundary	Steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	A
5	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
6	Flexible hose	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	A

Table 3.3.2-47 - Potable Water Supply System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
7	Piping	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
8	Piping	Leakage boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-271	3.3.1-93	A
9	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Piping	Leakage boundary	Steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	A
11	Piping	Leakage boundary	Steel with internal coating/lining	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A, 313
12	Piping	Leakage boundary	Steel with internal coating/lining	Raw water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.E5.A-416 (LR-ISG-2013-01)	3.3.1-138	A, 313

Table 3.3.2-47 - Potable Water Supply System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
13	Piping	Leakage boundary	Steel with internal coating/lining	Raw water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.E5.A-414 (LR-ISG-2013-01)	3.3.1-139	A, 312
14	Pump casing	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
15	Pump casing	Leakage boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-271	3.3.1-93	A
16	Tank (Water heater lining)	Leakage boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-271	3.3.1-93	A
17	Tank (Water heater)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
18	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-47 - Potable Water Supply System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
19	Valve body	Leakage boundary	Copper alloy <15% Zn	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-271	3.3.1-93	A
20	Valve body	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
21	Valve body	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	A
22	Valve body	Leakage boundary	Gray cast iron	Raw water (Int)	Loss of material	Selective Leaching	VII.C1.A-51	3.3.1-72	B

Table 3.3.2-48
Auxiliary Systems – Rx Plant Sampling
Summary of Aging Management Evaluation

Table 3.3.2-48 – Rx Plant Sampling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
4	Filter housing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
5	Heat exchanger (Sample bath coil)	Leakage boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	D
6	Heat exchanger (Sample bath coil)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	A
7	Heat exchanger (Sample bath shell)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	B
8	Heat exchanger (Sample bath shell)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	A
9	Heat exchanger (Sample cooler shell)	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
10	Heat exchanger (Sample cooler shell)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A

Table 3.3.2-48 – Rx Plant Sampling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	B
12	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
13	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	A
14	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VII.E3.AP-112	3.3.1-20	A
15	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	B
16	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	A
17	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	B
18	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E3.AP-189	3.3.1-46	A
19	Sample sink	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	B
20	Sample sink	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	A
21	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
22	Sight glass	Leakage boundary	Glass	Treated water (Int)	None	None	VII.J.AP-51	3.3.1-117	B

Table 3.3.2-48 – Rx Plant Sampling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
23	Sight glass (Body)	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
24	Sight glass (Body)	Leakage boundary	Copper alloy <15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-140	3.3.1-22	B
25	Sight glass (Body)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	D
26	Sight glass (Body)	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	A
27	Valve body	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	B
28	Valve body	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	A
29	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	C
30	Valve body	Leakage boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A
31	Valve body	Leakage boundary	Copper alloy >15% Zn	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	A
32	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
33	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
34	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VII.E3.AP-112	3.3.1-20	D

Table 3.3.2-48 – Rx Plant Sampling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
35	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
36	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
37	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
38	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E3.AP-189	3.3.1-46	C

Table 3.3.2-49
Auxiliary Systems – Radwaste Building Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-49 - Radwaste Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
2	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-50
Auxiliary Systems – Reactor Vessel Servicing Equipment
Summary of Aging Management Evaluation

Table 3.3.2-50 – Reactor Vessel Servicing Equipment								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
No Components Subject to Aging Management.								

Table 3.3.2-51
Auxiliary Systems – Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer
Summary of Aging Management Evaluation

Table 3.3.2-51 - Reactor Water Clean-up Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Filter housing	Leakage Boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
6	Filter housing	Leakage Boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
7	Filter-demin housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Filter-demin housing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
9	Flow restrictor	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Flow restrictor	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A

Table 3.3.2-51 - Reactor Water Clean-up Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Flow restrictor	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
12	Flow restrictor	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
13	Heat exchanger (Channel)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
14	Heat exchanger (Channel)	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	C
15	Heat exchanger (Channel)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	C
16	Heat exchanger (Channel)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	D
17	Heat exchanger (Shell)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
18	Heat exchanger (Shell)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.E3.AP-189	3.3.1-46	A
19	Heat exchanger (Shell)	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	C
20	Heat exchanger (Shell)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	C
21	Heat exchanger (Shell)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	D
22	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-51 - Reactor Water Clean-up Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
23	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
24	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
25	Orifice	Flow restriction, Pressure boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
26	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
27	Orifice	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
28	Orifice	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
29	Orifice	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
30	Orifice	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
31	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
32	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
33	Piping	Leakage boundary	Stainless steel	Treated water >60˚C (>140˚F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B

Table 3.3.2-51 - Reactor Water Clean-up Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
34	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
35	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
36	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
37	Piping	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A
38	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
39	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
40	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
41	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
42	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
43	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
44	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
45	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A

Table 3.3.2-51 - Reactor Water Clean-up Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
46	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
47	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
48	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
49	Pump casing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
50	Pump casing	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
51	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
52	Sight glass	Leakage boundary	Glass	Treated water (Int)	None	None	VII.J.AP-51	3.3.1-117	A
53	Sight glass (Body)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
54	Sight glass (Body)	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
55	Strainer body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
56	Strainer body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-51 - Reactor Water Clean-up Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
57	Tank	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
58	Tank	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	D
59	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
60	Valve body	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Selective Leaching	VII.E3.AP-32	3.3.1-72	B
61	Valve body	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-140	3.3.1-22	B
62	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
63	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
64	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
65	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
66	Valve body	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
67	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-51 - Reactor Water Clean-up Reactor Water Clean Up and Reactor Water Clean Up Filter Demineralizer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
68	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
69	Valve body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A
70	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
71	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
72	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
73	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
74	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
75	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A
76	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
77	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-52
Auxiliary Systems – Safety Related Instrument Air
Summary of Aging Management Evaluation

Table 3.3.2-52 - Safety-Related Instrument Air System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
7	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Piping	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A

Table 3.3.2-52 - Safety-Related Instrument Air System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Piping	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-280	3.3.1-95	A
11	Piping	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
12	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
13	Piping	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
14	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
15	Tank (Air storage)	Pressure boundary	Steel with stainless steel cladding	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
16	Tank (Air storage)	Pressure boundary	Steel with stainless steel cladding	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
17	Tank (Air storage)	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309

Table 3.3.2-52 - Safety-Related Instrument Air System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
18	Tank (Air storage)	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	C
19	Tank (Condensate receiver / separator)	Leakage boundary	Polymers	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-268	3.3.1-119	C, 310
20	Tank (Condensate receiver / separator)	Leakage boundary	Polymers	Condensation (Int)	None	None	VII.J.AP-269	3.3.1-119	C, 310
21	Tank (Condensate receiver / separator)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
22	Tank (Condensate receiver / separator)	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-280	3.3.1-95	A
23	Valve body	Leakage boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
24	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-52 - Safety-Related Instrument Air System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
25	Valve body	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A
26	Valve body	Leakage boundary	Steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-4	3.3.1-121	E, 309
27	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
28	Valve body	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
29	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
30	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A
31	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.D.A-80	3.3.1-78	A, 311
32	Valve body	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309

Table 3.3.2-52 - Safety-Related Instrument Air System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
33	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-53
Auxiliary Systems – Sanitary Drains and Sewer
Summary of Aging Management Evaluation

Table 3.3.2-53 - Sanitary Drains and Sewer Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Piping	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
4	Piping	Leakage boundary	Copper alloy >15% Zn	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	A
5	Piping	Leakage boundary	Copper alloy >15% Zn	Waste water (Int)	Loss of material	Selective Leaching	VII.E5.A-407 (LR-ISG-2012-02)	3.3.1-72	B
6	Piping	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-53 - Sanitary Drains and Sewer Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
7	Piping	Leakage boundary	Gray cast iron	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
8	Piping	Leakage boundary	Gray cast iron	Waste water (Int)	Loss of material	Selective Leaching	VII.E5.A-407 (LR-ISG-2012-02)	3.3.1-72	B
9	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Piping	Leakage boundary	Steel	Concrete (Ext)	None	None	VII.J.AP-282	3.3.1-112	A
11	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
12	Piping	Pressure boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
13	Piping	Pressure boundary	Copper alloy >15% Zn	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	A

Table 3.3.2-53 - Sanitary Drains and Sewer Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
14	Piping	Pressure boundary	Copper alloy >15% Zn	Waste water (Int)	Loss of material	Selective Leaching	VII.E5.A-407 (LR-ISG-2012-02)	3.3.1-72	B
15	Piping	Pressure boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
16	Piping	Pressure boundary	Gray cast iron	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
17	Piping	Pressure boundary	Gray cast iron	Waste water (Int)	Loss of material	Selective Leaching	VII.E5.A-407 (LR-ISG-2012-02)	3.3.1-72	B
18	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
19	Piping	Pressure boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
20	Pump casing (Sewage ejector)	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-53 - Sanitary Drains and Sewer Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
21	Pump casing (Sewage ejector)	Leakage boundary	Gray cast iron	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
22	Pump casing (Sewage ejector)	Leakage boundary	Gray cast iron	Waste water (Int)	Loss of material	Selective Leaching	VII.E5.A-407 (LR-ISG-2012-02)	3.3.1-72	B
23	Valve body	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
24	Valve body	Leakage boundary	Gray cast iron	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
25	Valve body	Leakage boundary	Gray cast iron	Waste water (Int)	Loss of material	Selective Leaching	VII.E5.A-407 (LR-ISG-2012-02)	3.3.1-72	B

Table 3.3.2-54
Auxiliary Systems – Service Air and Instrument Air
Summary of Aging Management Evaluation

Table 3.3.2-54 - Service Air and Instrument Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
6	Bolting	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
7	Drain trap	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Drain trap	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A

Table 3.3.2-54 - Service Air and Instrument Air Systems

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Flexible hose	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
10	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
11	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
12	Piping	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A
13	Piping	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	A
14	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
15	Piping	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-280	3.3.1-95	A
16	Piping	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309

Table 3.3.2-54 - Service Air and Instrument Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
17	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
18	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
19	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
20	Piping	Structural integrity	Copper alloy <15% Zn	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-8	3.3.1-114	E, 309
21	Piping	Structural integrity	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
22	Piping	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
23	Piping	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
24	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-54 - Service Air and Instrument Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
25	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
26	Pump casing (Compressor oil)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
27	Pump casing (Compressor oil)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
28	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
29	Sight glass	Leakage boundary	Glass	Condensation (Int)	None	None	VII.J.AP-97	3.3.1-117	A
30	Sight glass	Leakage boundary	Glass	Lubricating oil (Int)	None	None	VII.J.AP-15	3.3.1-117	A
31	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
32	Sight glass (Body)	Leakage boundary	Copper alloy >15% Zn	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	A

Table 3.3.2-54 - Service Air and Instrument Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
33	Tank (Compressor oil)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
34	Tank (Compressor oil)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	C
35	Valve body	Leakage boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A
36	Valve body	Leakage boundary	Aluminum	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1.AP-142	3.3.1-92	A
37	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
38	Valve body	Leakage boundary	Stainless steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-273	3.3.1-95	A
39	Valve body	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	A

Table 3.3.2-54 - Service Air and Instrument Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
40	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
41	Valve body	Leakage boundary	Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-280	3.3.1-95	A
42	Valve body	Pressure boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
43	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-123	3.3.1-120	A
44	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
45	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
46	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
47	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A

Table 3.3.2-54 - Service Air and Instrument Air Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
48	Valve body	Structural integrity	Aluminum	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-134	3.3.1-113	E, 309
49	Valve body	Structural integrity	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-135	3.3.1-113	A
50	Valve body	Structural integrity	Copper alloy <15% Zn	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-8	3.3.1-114	E, 309
51	Valve body	Structural integrity	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
52	Valve body	Structural integrity	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
53	Valve body	Structural integrity	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
54	Valve body	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
55	Valve body	Structural integrity	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A

Table 3.3.2-55
Auxiliary Systems – Service Water
Summary of Aging Management Evaluation

Table 3.3.2-55 Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A, 305
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A, 305
3	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
4	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
5	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
6	Bolting	Pressure boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
7	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A, 305
8	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A, 305
9	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A, 305
10	Flexible hose	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A, 305
11	Orifice	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A

Table 3.3.2-55 Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
12	Orifice	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
13	Orifice	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409 (LR-ISG-2012-02)	3.3.1-134	A
14	Orifice	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 305
15	Orifice	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A, 305
16	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A, 305
17	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A, 305
18	Piping	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
19	Piping	Leakage boundary	Steel	Raw water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.C1.A-409 (LR-ISG-2012-01)	3.3.1-126	A

Table 3.3.2-55 Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
20	Piping	Leakage boundary	Steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408 (LR-ISG-2012-02)	3.3.1-134	A
21	Piping	Pressure boundary	Steel	Condensation (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.I.AP-284 (LR-ISG-2011-03)	3.3.1-109x	A
22	Piping	Pressure boundary	Steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408 (LR-ISG-2012-02)	3.3.1-134	A
23	Piping	Pressure boundary	Steel with internal coating/lining	Raw water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C1.A-416 (LR-ISG-2013-01)	3.3.1-138	A
24	Piping	Pressure boundary	Steel with internal coating/lining	Raw water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C1.A-414 (LR-ISG-2013-01)	3.3.1-139	A
25	Piping	Pressure boundary	Steel with internal coating/lining	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.C1.AP-198	3.3.1-106	A
26	Strainer body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A, 305

Table 3.3.2-55 Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
27	Strainer body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A, 305
28	Valve body	Leakage boundary	CASS	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A, 305
29	Valve body	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A, 305
30	Valve body	Leakage boundary	CASS	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
31	Valve body	Leakage boundary	CASS	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409 (LR-ISG-2012-02)	3.3.1-134	A
32	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A, 305
33	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A, 305
34	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A, 305
35	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-144	3.3.1-114	A, 305
36	Valve body	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 305

Table 3.3.2-55 Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
37	Valve body	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A, 305
38	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A, 305
39	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A, 305
40	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
41	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
42	Valve body	Leakage boundary	Stainless steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409 (LR-ISG-2012-02)	3.3.1-134	A
43	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A, 305
44	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A, 305

Table 3.3.2-55 Service Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
45	Valve body	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
46	Valve body	Leakage boundary	Steel	Raw water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.C1.A-409 (LR-ISG-2012-01)	3.3.1-126	A
47	Valve body	Leakage boundary	Steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408 (LR-ISG-2012-02)	3.3.1-134	A
48	Valve body	Pressure boundary	Steel	Condensation (Ext)	Loss of material	Buried and Underground Piping and Tanks	VII.I.AP-284 (LR-ISG-2011-03)	3.3.1-109x	A
49	Valve body	Pressure boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C1.A-405 (LR-ISG-2012-02)	3.3.1-132	A
50	Valve body	Pressure boundary	Steel	Raw water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408 (LR-ISG-2012-02)	3.3.1-134	A

Table 3.3.2-56
Auxiliary Systems – Standby Liquid Control
Summary of Aging Management Evaluation

Table 3.3.2-56 - Standby Liquid Control System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
5	Flexible hose	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
6	Flexible hose	Pressure boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B
7	Flow indicator	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
8	Flow indicator	Leakage boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B

Table 3.3.2-56 - Standby Liquid Control System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Flow indicator	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
10	Orifice	Flow restriction, Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
11	Orifice	Flow restriction, Pressure boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B
12	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
13	Orifice	Leakage boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B
14	Piping	Leakage boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309
15	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
16	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
17	Piping	Leakage boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B

Table 3.3.2-56 - Standby Liquid Control System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
18	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
19	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
20	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
21	Piping	Leakage boundary	Steel	Sodium pentaborate solution (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E3.AP-106	3.3.1-21	E, 301
22	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E3.AP-106	3.3.1-21	E
23	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
24	Piping	Pressure boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B

Table 3.3.2-56 - Standby Liquid Control System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
25	Pump casing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
26	Pump casing	Leakage boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B
27	Pump casing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
28	Pump casing	Pressure boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B
29	Tank	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
30	Tank	Leakage boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	D
31	Tank	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
32	Tank	Pressure boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B
33	Tank	Pressure boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	D
34	Valve body	Leakage boundary	Stainless steel	Air – dry (Int)	None	Compressed Air Monitoring	VII.J.AP-20	3.3.1-120	E, 309

Table 3.3.2-56 - Standby Liquid Control System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
35	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	VII.J.AP-123	3.3.1-120	A
36	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
37	Valve body	Leakage boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B
38	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
39	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
40	Valve body	Leakage boundary	Steel	Sodium pentaborate solution (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E3.AP-106	3.3.1-21	E, 301
41	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E3.AP-106	3.3.1-21	E
42	Valve body	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-56 - Standby Liquid Control System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
43	Valve body	Pressure boundary	CASS	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B
44	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
45	Valve body	Pressure boundary	Stainless steel	Sodium pentaborate solution (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E2.AP-141	3.3.1-25	B

Table 3.3.2-57
Auxiliary Systems – Steam Tunnel Cooling
Summary of Aging Management Evaluation

Table 3.3.2-57 - Steam Tunnel Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
2	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Table 3.3.2-58
Auxiliary Systems – Storm Drain and Sewer
Summary of Aging Management Evaluation

Table 3.3.2-58 – Storm Drain and Sewer System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
No Components Subject to Aging Management									

Table 3.3.2-59
Auxiliary Systems – Suppression Pool Drain and Clean Up
Summary of Aging Management Evaluation

Table 3.3.2-59 - Suppression Pool Drain and Clean Up System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
6	Orifice	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
7	Orifice	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
8	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
9	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
10	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-59 - Suppression Pool Drain and Clean Up System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408 (LR-ISG-2012-01)	3.3.1-126	A
12	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
13	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
14	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
15	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
16	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408 (LR-ISG-2012-01)	3.3.1-126	A
17	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
18	Pump casing	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
19	Pump casing	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
20	Valve body	Leakage boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
21	Valve body	Leakage boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B

Table 3.3.2-59 - Suppression Pool Drain and Clean Up System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
22	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
23	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
24	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
25	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
26	Valve body	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
27	Valve body	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
28	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
29	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408 (LR-ISG-2012-01)	3.3.1-126	A
30	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-60
Auxiliary Systems – Suppression Pool Makeup
Summary of Aging Management Evaluation

Table 3.3.2-60 - Suppression Pool Makeup System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
4	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
5	Piping	Pressure boundary	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
6	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
7	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
9	Valve body	Pressure boundary	CASS	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
10	Valve body	Pressure boundary	CASS	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B

Table 3.3.2-60 - Suppression Pool Makeup System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
11	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
12	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.A4.AP-110	3.3.1-25	B
13	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
14	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-61
Auxiliary Systems – Turbine Building Chilled Water
Summary of Aging Management Evaluation

Table 3.3.2-61 - Turbine Building Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	A
4	Bolting	Leakage boundary	Steel	Condensation (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	A, 308
5	Filter housing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
6	Filter housing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
7	Heat exchanger (Channel)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
8	Heat exchanger (Channel)	Leakage boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.AP-109	3.3.1-79	C

Table 3.3.2-61 - Turbine Building Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Heat exchanger (Channel)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
10	Heat exchanger (Channel)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
11	Heat exchanger (Channel)	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	C
12	Heat exchanger (Shell)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
13	Heat exchanger (Shell)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.H2.AP-131	3.3.1-98	A
14	Heat exchanger (Ventilation cooling coil)	Leakage boundary	Copper alloy <15% Zn	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
15	Heat exchanger (Ventilation cooling coil)	Leakage boundary	Copper alloy <15% Zn	Condensation (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143 (LR-ISG-2012-02)	3.3.1-89	C
16	Heat exchanger (Ventilation cooling header)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-61 - Turbine Building Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
17	Heat exchanger (Ventilation cooling header)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
18	Orifice	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
19	Orifice	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
20	Orifice	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
21	Orifice	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
22	Orifice	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
23	Piping	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
24	Piping	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
25	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A

Table 3.3.2-61 - Turbine Building Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
26	Piping	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
27	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-110	3.3.1-25	B
28	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
29	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
30	Piping	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
31	Piping	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
32	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B
33	Pump casing	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
34	Pump casing	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	B

Table 3.3.2-61 - Turbine Building Chilled Water System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
35	Pump casing	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
36	Pump casing	Leakage boundary	Gray cast iron	Condensation (Ext)	Loss of material	Selective Leaching	VII.C1.A-51	3.3.1-72	B, 333
37	Pump casing	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
38	Pump casing	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
39	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-14	3.3.1-117	A
40	Sight glass	Leakage boundary	Glass	Lubricating oil (Int)	None	None	VII.J.AP-15	3.3.1-117	A
41	Sight glass (Body)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
42	Sight glass (Body)	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
43	Tank	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A

Table 3.3.2-61 - Turbine Building Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
44	Tank	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
45	Tank	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
46	Tank	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	C
47	Tank	Leakage boundary	Steel with internal coating/lining	Closed-cycle cooling water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VII.C2.A-414 (LR-ISG-2013-01)	3.3.1-139	A
48	Tank	Leakage boundary	Steel with internal coating/lining	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
49	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A
50	Valve body	Leakage boundary	Copper alloy <15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
51	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-61 - Turbine Building Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
52	Valve body	Leakage boundary	Copper alloy >15% Zn	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-133	3.3.1-99	A
53	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VII.J.AP-17	3.3.1-120	A
54	Valve body	Leakage boundary	Stainless steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
55	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
56	Valve body	Leakage boundary	Stainless steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A
57	Valve body	Leakage boundary	Stainless steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-138	3.3.1-100	A
58	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
59	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
60	Valve body	Leakage boundary	Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.C2.A-405 (LR-ISG-2012-02)	3.3.1-132	A

Table 3.3.2-61 - Turbine Building Chilled Water System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
61	Valve body	Leakage boundary	Steel	Lubricating oil (Int)	Loss of material	Lubricating Oil Analysis and One-Time Inspection	VII.C2.AP-127	3.3.1-97	A
62	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VII.E3.AP-106	3.3.1-21	B

Table 3.3.2-62
Auxiliary Systems – Turbine Building Closed Cooling
Summary of Aging Management Evaluation

Table 3.3.2-62 - Turbine Building Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	A
3	Heat exchanger (Channel)	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
4	Heat exchanger (Channel)	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
5	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
6	Piping	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
7	Valve body	Leakage boundary	Gray cast iron	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
8	Valve body	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
9	Valve body	Leakage boundary	Gray cast iron	Closed-cycle cooling water (Int)	Loss of material	Selective Leaching	VII.C2.A-50	3.3.1-72	B

Table 3.3.2-62 - Turbine Building Closed Cooling System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.A-77	3.3.1-78	A
11	Valve body	Leakage boundary	Steel	Closed-cycle cooling water (Int)	Loss of material	Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A

Table 3.3.2-63
Auxiliary Systems – Turbine Building Ventilation
Summary of Aging Management Evaluation

Table 3.3.2-63 - Turbine Building Ventilation System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.F2.A-10	3.3.1-78	A
2	Damper housing	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A

Notes for Table 3.3.2-1 through Table 3.3.2-63

Standard Notes

A	Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material, and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination are evaluated in NUREG-1801.

Plant-Specific Notes

301	Sodium pentaborate solution is a subset of treated water that results in similar aging effects for steel components. Steel piping exposed to sodium pentaborate when system is tested, drained, or are tank overflow lines. Lines are typically drained.
302	LR-ISG-2013-01 did not add NUREG-1801 rows for loss of material in fuel oil. However, the XI.M42 program includes acceptance criteria which supports management of loss of material in the metallic substrate in closed-cycle cooling water, raw water, treated water, treated borated water, waste water, fuel oil, and lubricating oil. This loss of material of the metallic substrate exposed to fuel oil is also managed under the Fuel Oil Chemistry and the One-Time Inspection programs.
303	Aging evaluation of glass with an internal environment of air is equivalent to the aging evaluation of glass with an external environment of indoor air.
304	Aging of the diesel fire pump jacket water HX is managed by the Fire Water System program.

Plant-Specific Notes (Continued)

305 The Service Water supply to the Alternate Decay Heat Removal system is normally drained and blown dry. Internal and external environments are air.

306 Closed-cycle cooling water is considered a subset of Treated water for this GALL comparison. Erosion identified by site OE in this system is managed by the Flow-Accelerated Corrosion program.

307 Components provide only structural support, and are isolated, with internal environment of air. Internal aging effects are expected to be similar to those visible externally.

308 Condensation environment is considered to be equivalent to Air - outdoor (external) for Loss of preload aging management comparison.

309 The Compressed Air Monitoring program provides assurance that the quality of the "Air - dry" environment supports the conclusion that no aging effects are expected.

310 Based on plant operating experience, there are no aging effects requiring management for the polymer Fire Protection water sight glasses, or Safety-Related Instrument Air condensate tank. Polymers are not expected to experience aging effects unless exposed to elevated temperatures or radiation levels capable of attacking the specific chemical composition. The sight glass is not PVC, but is a transparent polymer. These components are exposed to indoor air externally, and to condensation or fire water internally. These environments do not include elevated temperatures or radiation levels.

311 Internal Environment of the exhaust side CS - Relief Valve body parts is Air-Uncontrolled. External surface is the same or more severe environment. So monitoring the external surfaces will be indicative of internal CS parts.

312 Galvanic Corrosion mechanism results since susceptibility assumes a more cathodic metal is connected to the piping system.

313 Only small portion of Potable water system has an internal lining. A part of this pipe section is in the Control Complex is treated as a separate component.

314 This piping section of pipe is connected to discharge flapper valve (0P64F0511) and encased in concrete. Internal surface of the valve is representative of the piping condition.

315 Visual inspection of bolts securing discharge flapper valve (0P64F0511) is needed since leakage is not expected in a normally depressurized pipe. This valve prevents backflow into Diesel Generator Buildings in the event of flooding.

Plant-Specific Notes (Continued)

316 The 2 inch vent pipes on top of the Oil Interceptor Tank 0P64A0001 are exposed to soil and are included with piping in this AMP line item.

317 This component is PY-0P64F0511 and the attached piping up to the concrete Sludge Holding Sump.

318 External surface of vent pipes or intake filter housing is the same or more severe environment. So, monitoring the external surfaces will be indicative of internal surface.

319 Thermocouples in Reactor Recirculation System are installed in Nuclear Closed Cooling System piping.

320 Spray Header is normally below water level in the upper pools. When pools are drained down for refueling they are exposed to air indoors.

321 Liquid Radwaste is a waste water system and it has no downstream components in the scope of License Renewal. The program selected will manage loss of material due to corrosion.

322 Roof Drains are gray cast iron body in outdoor air and is treated as steel and managed by external surfaces program. Selective leaching is not expected in an outdoor air environment. Moist air or condensation (Internal) is considered equivalent to Outdoor air.

323 In addition to the Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components", additional testing, inspections, and reporting to be performed per Commitment L01090.

324 Bolting Integrity Program is enhanced to perform visual inspection of submerged bolting for ESW/ESW Screenwash pumps, diesel/motor fire pumps, Suppression Pool Suction Strainer, and Spent Fuel Rack Grid Structure for loss of material and loss of preload.

325 Although buried piping and tanks have special coatings or wrappings, no credit for mitigating aging effects are taken, and in this case, the material of steel is considered equivalent for comparison to NUREG-1801 table 2 Items.

326 The component is located within HVAC ducting and components, and the external surfaces of this component are subject to the internal HVAC environment during normal operation. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program performs visual inspections which are capable of identifying aging mechanisms which cause reduction of heat transfer.

327 Represents miscellaneous floor drains, equipment drain pans, and funnels with leakage boundary intended function highlighted on system boundary drawings.

Plant-Specific Notes (Continued)

328	In this section of stainless steel piping, the vast majority is below the threshold temperature for cracking due to SSC/IGSCC. The smaller amount up to the automatic vent valves are greater than the threshold temperatures.
329	Emergency Closed Cooling Pump Area fans do not normally operate, and chilled water does not bypass the coils. Chilled water in NSR area coolers and SR plenums may bypass the coils based upon exit temperature, but are conservatively assumed to experience condensation. Reduction in heat transfer is assumed due to fouling from debris or corrosion, which can be detected by visual inspection.
330	This bolting attaches the external, fire pump inlet strainer elements to the suction bowls. Loss of preload is not applicable aging effect since this is not a joint and would not fail its intended function.
331	Ductile Iron is considered the same as Gray Cast Iron for assignment of aging effects and AMPs which is consistent with NUREG-2191 (GALL-SLR).
332	External surface of elastomers in ventilation system duct and flexible connections is the same as the internal environment. So, monitoring the external surfaces will be indicative of internal surface. In addition to the Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components", additional testing, inspections, and reporting to be performed per Commitment L01090.
333	Per definitions in NUREG-1801, Section IX, Condensation is considered Raw Water.
334	Surfaces are not exposed to prolonged wetting other than humidity. Per EPRI Report 1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, Appendix E, Section 3.5, "Zinc is used (as a coating) because of its corrosion resistance in an external environment and because it provides galvanic protection of the base metal where discontinuities or damage of the coating has occurred." In this case, the valve body base material is zinc and not steel. In an air-dry and air-indoor, uncontrolled environments, Zinc is resistant to corrosion and similar to galvanized steel.
335	Aging effect is per EPRI Report 1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, Appendix G, Table 6-7. The assigned program is capable of detecting the aging effect.
336	Aging effect is per EPRI Report 1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, Appendix C, Table 4-2 with potential for water pooling assumed. The assigned inspection program is capable of detecting the aging effect and fuel oil chemistry program is preventative by ensuring water is removed.
337	Fatigue is a TLAA. See LRA Section 3.3.2.3 for further evaluation.

Plant-Specific Notes (Continued)

338 Surfaces are not exposed to prolonged wetting other than humidity. Per EPRI Report 1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, Appendix E, Section 3.5, "Zinc is used (as a coating) because of its corrosion resistance in an external environment and because it provides galvanic protection of the base metal where discontinuities or damage of the coating has occurred." In this case, the valve body base material is zinc and not steel. In an air-dry and air-indoor, uncontrolled environments, Zinc is resistant to corrosion and similar to galvanized steel in either environment. The Compressed Air Monitoring program provides assurance that the quality of the "Air - dry" environment supports the conclusion that no aging effects are expected.

3.4 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEMS

3.4.1 INTRODUCTION

This section provides the results of the aging management review for those components identified in Section 2.3.4, Steam and Power Conversion System, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section are described in the indicated sections.

- Auxiliary Steam and Drains (Section 2.3.4.1)
- Condensate (Section 2.3.4.2)
- Condensate Transfer and Storage (Section 2.3.4.3)
- Control Rod Drive Rebuild Equipment (Section 2.3.4.4)
- Extraction Steam (Section 2.3.4.5)
- Feed Water Control, Feedwater and Feedwater Leakage Control (Section 2.3.4.6)
- Main Condenser (including the main turbine shell) (Section 2.3.4.7)
- Main and Reheat Steam (Section 2.3.4.8)
- Main, Reheat, Extraction, and Miscellaneous Drain (Section 2.3.4.9)
- Respirator Cleaning (Section 2.3.4.10)
- Service Water and Emergency Service Water Chlorination (Section 2.3.4.11)
- Two Bed Demineralizer and Distribution, and Mixed Bed Demineralizer and Distribution (Section 2.3.4.12)

3.4.2 RESULTS

The following tables summarize the results of the aging management review for Steam and Power Conversion System.

- Table 3.4.2-1 Auxiliary Steam and Drains
- Table 3.4.2-2 Condensate
- Table 3.4.2-3 Condensate Transfer and Storage
- Table 3.4.2-4 Control Rod Drive Rebuild Equipment
- Table 3.4.2-5 Extraction Steam
- Table 3.4.2-6 Feed Water Control, Feedwater and Feedwater Leakage Control
- Table 3.4.2-7 Main Condenser (including the main turbine shell)
- Table 3.4.2-8 Main and Reheat Steam
- Table 3.4.2-9 Main, Reheat, Extraction, and Miscellaneous Drain

- Table 3.4.2-10 Respirator Cleaning
- Table 3.4.2-11 Service Water and Emergency Service Water Chlorination
- Table 3.4.2-12 Two Bed Demineralizer and Distribution, and Mixed Bed Demineralizer and Distribution

Note that the Extraction Steam system does not have any mechanical components subject to aging management review and the corresponding AMR results table contains no components.

3.4.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the steam and power conversion systems components subject to aging management review. Aging management programs are described in Appendix B. Further details are provided in the system tables.

3.4.2.1.1 Auxiliary Steam and Drains

Materials

Auxiliary Steam and Drains system components are constructed of the following materials:

- Steel

Environments

Auxiliary Steam and Drains system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Auxiliary Steam and Drains system require management:

- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Auxiliary Steam and Drains system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.4.2.1.2 Condensate

Materials

Condensate system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Condensate system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Condensate system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Condensate system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.4.2.1.3 Condensate Transfer and Storage

Materials

Condensate Transfer and Storage system components are constructed of the following materials:

- Stainless steel
- Steel
- Steel with internal coating/lining

Environments

Condensate Transfer and Storage system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Soil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Condensate Transfer and Storage system require management:

- Cracking
- Loss of coating or lining integrity
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Condensate Transfer and Storage system components:

- Aboveground Metallic Tanks (B.2.2)
- Bolting Integrity (B.2.7)
- Buried and Underground Piping and Tanks (B.2.8)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks (B.2.27)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.4.2.1.4 Control Rod Drive Rebuild Equipment

Materials

Control Rod Drive Rebuild Equipment system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Control Rod Drive Rebuild Equipment system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Control Rod Drive Rebuild Equipment system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Control Rod Drive Rebuild Equipment system components:

- Bolting Integrity (B.2.7)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.4.2.1.5 Extraction Steam

The N36 Extraction Steam system does not contain any mechanical components that are safety-related, or that are credited for regulated events. The N36 system does contain mechanical components that are non-safety related whose failure could result in failure of a safety related function. However, all of those components are active and are not subject to aging management review. No N36 system components perform a pressure boundary or leakage boundary intended function. The Extraction Steam system components are not subject to aging management.

Materials

Extraction Steam system components are constructed of the following materials:

- N/A

Environments

Extraction Steam system components are exposed to the following environments:

- N/A

Aging Effects Requiring Management

The following aging effects associated with the Extraction Steam system require management:

- N/A

Aging Management Programs

The following aging management programs manage the effects of aging on Extraction Steam system components:

- N/A

3.4.2.1.6 Feed Water Control, Feedwater and Feedwater Leakage Control

Materials

Feed Water Control, Feedwater and Feedwater Leakage Control systems components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Feed Water Control, Feedwater and Feedwater Leakage Control systems components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water
- Treated water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the Feed Water Control, Feedwater and Feedwater Leakage Control systems require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Feed Water Control, Feedwater and Feedwater Leakage Control systems components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.4.2.1.7 Main Condenser (including the main turbine shell)

Materials

Main Condenser system components are constructed of the following materials:

- Aluminum
- Stainless steel
- Steel

Environments

Main Condenser system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Main Condenser system components require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Main a Condenser system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)

- One-Time Inspection (B.2.35)
- Open-Cycle Cooling Water System (B.2.37)
- Water Chemistry (B.2.44)

3.4.2.1.8 Main and Reheat Steam

Materials

Main and Reheat Steam system components are constructed of the following materials:

- Stainless steel
- Steel

Environments

Main and Reheat Steam system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water
- Treated water >60°C (>140°F)

Aging Effects Requiring Management

The following aging effects associated with the Main and Reheat Steam system require management:

- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Main and Reheat Steam system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.4.2.1.9 Main, Reheat, Extraction, and Miscellaneous Drain

Materials

Main, Reheat, Extraction, and Miscellaneous Drain system components are constructed of the following materials:

- Steel

Environments

Main, Reheat, Extraction, and Miscellaneous Drain system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Main, Reheat, Extraction, and Miscellaneous Drain system require management:

- Cumulative fatigue damage
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Main, Reheat, Extraction, and Miscellaneous Drain system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Flow-Accelerated Corrosion (B.2.22)
- One-Time Inspection (B.2.35)
- TLAA
- Water Chemistry (B.2.44)

3.4.2.1.10 Respirator Cleaning

Materials

Respirator Cleaning system components are constructed of the following materials:

- Copper alloy >15% Zn
- Stainless steel
- Steel

Environments

Respirator Cleaning system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Treated water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Respirator Cleaning system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Respirator Cleaning system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- One-Time Inspection (B.2.35)
- Selective Leaching (B.2.42)
- Water Chemistry (B.2.44)

3.4.2.1.11 Service Water and Emergency Service Water Chlorination

Materials

Service Water and Emergency Service Water Chlorination components are constructed of the following materials:

- Glass
- Polymers
- Steel

Environments

Service Water and Emergency Service Water Chlorination components are exposed to the following environments:

- Air – indoor, uncontrolled

- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Service Water and Emergency Service Water Chlorination components require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Service Water and Emergency Service Water Chlorination components:

- Bolting Integrity (B.2.7)

3.4.2.1.12 Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution

Materials

Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution system components are constructed of the following materials:

- Copper alloy <15% Zn
- Stainless steel
- Steel

Environments

Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution system components are exposed to the following environments:

- Air – indoor, uncontrolled
- Concrete
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution system require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution system components:

- Bolting Integrity (B.2.7)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- One-Time Inspection (B.2.35)
- Water Chemistry (B.2.44)

3.4.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.4.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the PNPP approach to these areas requiring further evaluation. Programs are described in Appendix B.

Note - Italicized text at the beginning of each Further Evaluation subsection is taken directly from NUREG-1800 as supplemented by LR-ISG-2011-05 and LR-ISG-2012-02.

3.4.2.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-LR. The related GALL Report items invoked by the subsection are VIII.D1.S-11, VIII.D2.S-11, VIII.G.S-11, VIII.B1.S-08, VIII.B2.S-08.

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of metal fatigue as a TLAA for non-Class 1 components in the: Main and Reheat Steam, Main, Reheat, Extraction, and Miscellaneous Drains; Feedwater Control, Feedwater and Feedwater Leakage Control; and Auxiliary Steam and Drains systems is addressed in Section 4.3.2 either specifically or as part of the global evaluation. Likewise, in addition, the evaluation of metal fatigue as a TLAA for non-Class 1 components in the Auxiliary Systems (Reactor Water Clean Up system) is discussed in Section 4.3.2. See Section 4.3 for a complete evaluation of metal fatigue.

3.4.2.2.2 Cracking due to Stress Corrosion Cracking (SCC)

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The possibility of cracking also extends to components exposed to air which has recently *been introduced into buildings, i.e., components near intake vents. Cracking is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above.*

GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect. The applicant may demonstrate that this item is not applicable by describing the outdoor air environment present at the plant and demonstrating that external chloride stress corrosion cracking is not expected. The GALL Report recommends further evaluation to determine whether an adequate aging management program is used to manage this aging effect based on the environmental conditions applicable to the plant and ASME Code Section XI requirements applicable to the components.

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. This item is not applicable. Stainless steel components in the Steam and Power Conversion systems exposed to outdoor air are insulated. Cracking of these components is managed by the External Surfaces Monitoring of Mechanical Components program as addressed in Table 3.4.1 item 63. The External Surfaces Monitoring of Mechanical Components program is consistent with the recommendations of NUREG-1801, XI.M36 as modified by LR-ISG-2012-02.

3.4.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The possibility of pitting and crevice corrosion also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents. Pitting and crevice corrosion is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above.

GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect. The applicant may demonstrate that this item is not applicable by describing the outdoor air environment present at the plant and demonstrating that external pitting or crevice corrosion is not expected. The GALL Report recommends further evaluation to determine whether an adequate aging management program is used to manage this aging effect based on the environmental conditions applicable to the plant and ASME Code Section XI requirements Quality Assurance for Aging Management of Nonsafety-Related Components.

Loss of material could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. This item is not applicable. Stainless steel components in the Steam and Power Conversion systems exposed to outdoor air are insulated. Loss of material for these components is managed by the External Surfaces Monitoring of Mechanical Components program as addressed in Table 3.4.1 item 63. The External Surfaces Monitoring of Mechanical Components program is consistent with the recommendations of NUREG-1801, XI.M36 as modified by LR-ISG-2012-02.

3.4.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2, of this SRP-LR).

See Appendix B Section B.1.3 for discussion of PNPP quality assurance procedures and administrative controls for aging management programs.

3.4.2.2.5 Ongoing Review of Operating Experience (Per LR-ISG-2011-05)

Ongoing review of operating experience is addressed in Appendix A, Section A.1 and Appendix B, Section B.1.4.

3.4.2.2.6 Loss of Material due to Recurring Internal Corrosion

Recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL Report. During the search of plant-specific OE conducted during the LRA development, recurring internal corrosion can be identified by the number of occurrences of aging effects and the extent of degradation at each localized corrosion site. This further evaluation item is applicable if the search of plant-specific OE reveals repetitive occurrences (e.g., one per refueling outage cycle that has occurred over: (a) three or more sequential or nonsequential cycles for a 10-year OE search, or (b) two or more sequential or nonsequential cycles for a 5-year OE search) of aging effects with the same aging mechanism in which the aging effect resulted in the component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness.

The GALL Report recommends that a plant-specific AMP, or a new or existing AMP, be evaluated for inclusion of augmented requirements to ensure the adequate management of any recurring aging effect(s). Potential augmented requirements include: alternative examination methods (e.g., volumetric versus external visual), augmented inspections (e.g., a greater number of locations, additional locations based on risk insights based on susceptibility to aging effect and consequences of failure, a greater frequency of inspections), and additional trending parameters and decision points where increased inspections would be implemented. Acceptance criteria are described in Appendix A.1, "Aging Management Review – Generic (Branch Technical Position RSLB-1)."

The applicant states: (a) why the program's examination methods will be sufficient to detect the recurring aging effect before affecting the ability of a component to perform its intended function, (b) the basis for the adequacy of augmented or lack of augmented inspections, (c) what parameters will be trended as well as the decision points where increased inspections would be implemented (e.g., the extent of degradation at individual corrosion sites, the rate of degradation change), (d) how inspections of components that are not easily accessed (i.e., buried, underground) will be conducted, and (e) how leaks in any involved buried or underground components will be identified.

Each plant-specific operating experience example should be evaluated to determine if the chosen AMP should be augmented even if the thresholds for significance of aging effect or frequency of occurrence of aging effect have not been exceeded. For example, during a 10-year search of plant specific operating experience, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the operating experience should be evaluated to determine if the AMP that is proposed to manage the aging effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the CLB intended functions of the component will be met throughout the period of extended operation. Likewise, the GALL Report AMR items associated with the new FE items only cite raw water and waste water environments because OE indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific OE reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.

LR-ISG-2012-02 has been issued which addresses instances of recurring internal corrosion identified during review of plant-specific operating experience. The operating experience for PNPP has been reviewed and instances of internal corrosion in the Steam and Power Conversion Systems have not been identified with a frequency that is consistent with the thresholds discussed in LR-ISG-2012-02.

3.4.2.3 Time-Limited Aging Analysis

The time-limited aging analyses identified associated with Steam and Power Conversion system components are addressed in Section 4. Table 4.1-2 provides TLAA results and identifies whether the TLAA remains valid for the PEO, will be managed during the PEO and the LRA sections that address them.

3.4.3 CONCLUSION

The Steam and Power Conversion System piping, fittings, and components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage aging effects for the Steam and Power Conversion Systems components are identified in the summaries in Section 3.4.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Steam and Power Conversion System components will be adequately managed so that there is reasonable assurance that the intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-1	Steel Piping, piping components, and piping elements exposed to Steam or Treated water	Cumulative fatigue damage due to fatigue	Fatigue is a time- limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA (See subsection 3.4.2.2.1)	Consistent with NUREG-1801. Cumulative fatigue damage is evaluated as a TLAA. In addition to Steam and Power Conversion system components, components in the Reactor Water Clean-Up system are also aligned to this row. See further evaluation section 3.4.2.2.1.
3.4.1-2	Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated (See subsection 3.4.2.2.2)	Not applicable. Cracking of stainless steel components in the Steam and Power Conversion systems exposed to air - outdoor are addressed in item 3.4.1-63. See further evaluation section 3.4.2.2.2.
3.4.1-3	Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated (See subsection 3.4.2.2.3)	Not applicable. Loss of material of stainless steel components in the Steam and Power Conversion systems exposed to air - outdoor are addressed in item 3.4.1-63. See further evaluation section 3.4.2.2.3.
3.4.1-4	PWR only				

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-5	Steel Piping, piping components, and piping elements exposed to Steam, Treated water	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801. The Flow-Accelerated Corrosion program will manage wall thinning (loss of material) due to flow-accelerated corrosion of steel piping components exposed to treated water. The Main Condenser pressure boundary and internal structural components are also aligned with this item. In addition to Steam and Power Conversion system components, components in the Reactor Water Clean-Up system are aligned to this row. The environment name "Treated water" is used in this application to address both liquid and vapor phases.
3.4.1-6	Steel, Stainless Steel Bolting exposed to Soil	Loss of preload	Chapter XI.M18, "Bolting Integrity "	No	Consistent with NUREG-1801. The Bolting Integrity program will manage loss of preload for steel bolting exposed to soil.
3.4.1-7	High-strength steel Closure bolting exposed to Air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	Not applicable. There is no high-strength steel closure bolting exposed to air with steam or water leakage in the Steam and Power Conversion systems.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-8	Steel; stainless steel Bolting, Closure bolting exposed to Air – outdoor (External), Air – indoor, uncontrolled (External)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801 for steel bolting, with a difference identified for stainless steel bolting. The Bolting Integrity program will manage loss of material for steel bolting exposed to air – outdoor and air – indoor, uncontrolled. Loss of material for stainless steel bolting in air - indoor, uncontrolled was not identified as an applicable aging effect. EPRI 1010639 Appendix F (Bolted Closures) does not identify loss of material as an aging effect requiring management for stainless steel fasteners in indoor air. EPRI 1010639 Appendix E (External Surfaces) indicates that stainless steel may be susceptible to pitting and crevice corrosion in indoor air if: 1. Temperature <212˚F, and 2a. Surface is buried or subjected to a concentration of contaminants, or 2b. Surface is exposed to an aggressive environment in outdoor locations. The only stainless steel bolting subject to aging management review in the Steam and Power Conversion systems is

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					closure bolting for the Main Steam Line Shutoff valves, which are normally well above the threshold temperature for this aging effect in stainless steel, which precludes the presence of liquid water. Loss of preload for this bolting is managed by the Bolting Integrity program as addressed in item 3.4.1-10. Cumulative fatigue damage for this bolting is managed by TLAA, as addressed in item 3.1.1-11.
3.4.1-9	Steel Closure bolting exposed to Air with steam or water leakage	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	Not applicable. The environment name "Air with steam or water leakage" was not used to describe bolting environments. The Bolting Integrity program will manage loss of material for steel bolting exposed to an indoor air environment as addressed in item 3.4.1-8.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-10	Copper alloy, Nickel alloy, Steel; stainless steel, Steel; stainless steel Bolting, Closure bolting exposed to Any environment, Air – outdoor (External), Air – indoor, uncontrolled (External)	Loss of preload due to thermal effects, gasket creep, and self- loosening	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity program will manage loss of preload for steel and stainless steel bolting exposed to air - indoor, uncontrolled and air - outdoor. There is no copper alloy or nickel alloy closure bolting subject to aging management review in the Steam and Power Conversion systems. Loss of preload in steel bolting subject to aging management in the Steam and Power Conversion systems and exposed to soil is addressed in Item 3.4.1-6.
3.4.1-11	Stainless steel Piping, piping components, and piping elements, Tanks, Heat exchanger components exposed to Steam, Treated water >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One- Time Inspection”	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage cracking of stainless steel components exposed to treated water >60˚C (>140˚F), and the One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry Program. In addition to components in the Power Conversion Systems, components in the Nuclear Boiler, Reactor Recirculation, Residual Heat Removal, High Pressure Core

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					Spray, Low Pressure Core Spray, Reactor Core Isolation Cooling, Hydrogen Water Chemistry, Leakage Detection, Reactor Coolant Pressure Boundary and Reactor Water Clean-Up systems are also aligned to this row. Also, aligned are piping, piping components and piping elements and the High Pressure heater components in the Feedwater System. The Reactor Coolant Pressure Boundary system components are the main steam flow venturi inserts that are not pressure boundary components and a full bore RCIC flow element. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-12	Steel; stainless steel Tanks exposed to Treated water	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One- Time Inspection"	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage loss of material for steel and stainless steel tanks subject to aging management in the Steam and Power Conversion systems exposed to treated water. The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.4.1-13	PWR only				

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-14	Steel Piping, piping components, and piping elements, PWR heat exchanger components exposed to Steam, Treated water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One- Time Inspection”	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage loss of material for steel Piping, piping components, and piping elements subject to aging management in the Steam and Power Conversion systems exposed to treated water, steam. The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. The Main Condenser pressure boundary and internal structural components are aligned with this item. There are no PWR heat exchanger components as PNPP is a BWR. Also see Item 3.4.1-15. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-15	Steel Heat exchanger components exposed to Treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One- Time Inspection"	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage loss of material for steel, heat exchanger components subject to aging management in the Steam and Power Conversion systems exposed to treated water. The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. These components include steel HP Feedwater Heater components and the Main Condenser tubesheet. Also see item 3.4.1-14. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-16	Copper alloy, Stainless steel, Nickel alloy, Aluminum Piping, piping components, and piping elements, Heat exchanger components and tubes, PWR heat exchanger components exposed to Treated water, Steam	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One- Time Inspection"	No	Consistent with NUREG-1801 with some program exceptions. The Water Chemistry program will manage loss of material of copper alloy, aluminum, and stainless steel components exposed to treated water. The One-Time Inspection program will be used to confirm the effectiveness of the Water Chemistry program. In addition to components in the Steam and Power Conversion systems, copper alloy components in the Offgas system are also aligned to this row. Also, stainless steel, civil commodities for component and piping supports, Fuel Handling and Refueling Platforms, Fuel Prep Machine, and general purpose grapple1 in the Bulk Civil Commodities are aligned to this item. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.4.1-17	PWR only				

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-18	Copper alloy, Stainless steel Heat exchanger tubes exposed to Treated water	Reduction of heat transfer due to fouling	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One- Time Inspection”	No	Not applicable. There are no copper alloy heat exchanger tubes subject to aging management review in the Steam and Power Conversion systems that are exposed to treated water. There are no stainless steel heat exchanger tubes exposed to Treated water with an intended function of heat transfer in the Steam and Power Conversion systems. Other aging effects of the Number 6 feedwater heater tubes are addressed in table items 3.3.1-2, 3.4.1-11 and 3.4.1-16.
3.4.1-19	Stainless steel, Steel Heat exchanger components exposed to Raw Water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801 for material, environment, aging effect and AMP. The waterbox and tubesheet in the Main Condenser is aligned with this item. There are no stainless steel or other steel components subject to aging management in the Steam and Power Conversion systems exposed to raw water.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-20	Copper alloy, Stainless steel Piping, piping components, and piping elements exposed to Raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no copper alloy or stainless steel components subject to aging management review in the Steam and Power Conversion systems that are exposed to raw water.
3.4.1-21	PWR only				
3.4.1-22	Stainless steel, Copper alloy, Steel Heat exchanger tubes, Heat exchanger components exposed to Raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not applicable. There are no copper alloy, stainless steel heat exchanger components subject to aging management review in the Steam and Power Conversion systems that are exposed to raw water. There are no steel heat exchanger components subject to aging management review with a heat transfer intended function in the Steam and Power Conversion systems. See Table item 3.4.1-19 for management of loss of material in steel heat exchanger subject to aging management review exposed to raw water.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-23	Stainless steel Piping, piping components, and piping elements exposed to Closed-cycle cooling water >60˚C (>140˚F)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no components subject to aging management review in the Steam and Power Conversion systems that are exposed to closed - cycle cooling water >60˚C (>140˚F).
3.4.1-24	Steel Heat exchanger components exposed to Closed-cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no components subject to aging management review in the Steam and Power Conversion systems that are exposed to closed-cycle cooling water.
3.4.1-25	Steel Heat exchanger components exposed to Closed-cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no components subject to aging management review in the Steam and Power Conversion systems that are exposed to closed-cycle cooling water.
3.4.1-26	Stainless steel Heat exchanger components, Piping, piping components, and piping elements exposed to Closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no components subject to aging management review in the Steam and Power Conversion systems that are exposed to closed - cycle cooling water.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-27	Copper alloy Piping, piping components, and piping elements exposed to Closed-cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no components subject to aging management review in the Steam and Power Conversion systems that are exposed to closed-cycle cooling water.
3.4.1-28	Steel, Stainless steel, Copper alloy Heat exchanger components and tubes, Heat exchanger tubes exposed to Closed-cycle cooling water	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not applicable. There are no heat exchanger components subject to aging management review in the Steam and Power Conversion systems that are exposed to closed-cycle cooling water.
3.4.1-29	Steel Tanks exposed to Air – outdoor (External)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Consistent with NUREG-1801. The Aboveground Metallic Tanks program will manage loss of material for the steel Condensate Storage Tan exposed to air-outdoor. No other tanks are within the scope of the Aboveground Metallic Tanks program.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-30 (LR-ISG-2012-02)	Steel, Stainless Steel, Aluminum Tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to Soil or Concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Loss of material due to general (steel only), pitting, and crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The Aboveground Metallic Tanks program will manage loss of material for the external bottom surface of the steel Condensate Storage Tank that is exposed to soil. No other tanks are within the scope of the Aboveground Metallic Tanks program and no stainless steel or aluminum materials comprising the Condensate Storage Tank that is exposed to soil or concrete or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation. For steel components comprising the Condensate Storage Tank and exposed to air-outdoor, see item 3.4.1-29.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-31 (LR-ISG-2012-02)	Stainless steel, Aluminum Tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to Soil or Concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Loss of material due to pitting, and crevice corrosion; cracking due to stress corrosion cracking	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not applicable. There are no stainless steel or aluminum tanks within the scope of the Aboveground Metallic Tanks program.
3.4.1-32	Gray cast iron Piping, piping components, and piping elements exposed to Soil	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not applicable. There are no gray cast iron components subject to aging management review in the Steam and Power Conversion systems that are exposed to soil.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-33	Gray cast iron, Copper alloy (>15% Zn or >8% Al) Piping, piping components, and piping elements exposed to Treated water, Raw water, Closed-cycle cooling water	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Consistent with NUREG-1801 with some program exceptions. The Selective Leaching program will manage loss of material due to selective leaching for copper alloy (>15% Zn or >8% Al) components exposed to treated water. There are no gray cast iron components subject to aging management review that are exposed to treated water, raw water or closed - cycle cooling water, and no copper alloy (>15% Zn or >8% Al) components subject to aging management review that are exposed to raw water or closed - cycle cooling water in the Steam and Power Conversion systems. See Appendix B Section B.2.42 for Selective Leaching program exceptions to NUREG-1801.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-34	Steel External surfaces exposed to Air – indoor, uncontrolled (External), Air – outdoor (External), Condensation (External)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. The External Surfaces Monitoring of Mechanical Components program will manage loss of material for steel components in the Steam and Power Conversion systems exposed to air - indoor, uncontrolled. Steel components exposed to air - outdoor are addressed in Items 3.4.1-8, 3.4.1-29 and 3.4.1-63. There are no steel components subject to aging management review in the Steam and Power Conversion systems that are exposed to condensation.
3.4.1-35	Aluminum Piping, piping components, and piping elements exposed to Air - outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. There are no aluminum components subject to aging management review in the Steam and Power Conversion systems that are exposed to air - outdoor.
3.4.1-36	PWR only				
3.4.1-37	Steel Piping, piping components, and piping elements exposed to Condensation (Internal)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable. There are no steel components subject to aging management review in the Steam and Power Conversion systems that are exposed to an internal environment of condensation.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-38	PWR only				
3.4.1-39	Stainless steel Piping, piping components, and piping elements exposed to Condensation (Internal)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not applicable. There are no stainless steel components subject to aging management review in the Steam and Power Conversion systems that are exposed to an internal environment of condensation.
3.4.1-40	Steel Piping, piping components, and piping elements exposed to Lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, “One-Time Inspection”	No	Not applicable. There are no steel components subject to aging management review in the Steam and Power Conversion systems that are exposed to lubricating oil.
3.4.1-41	PWR only				
3.4.1-42	PWR only				
3.4.1-43	Copper alloy Piping, piping components, and piping elements exposed to Lubricating oil	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, “One-Time Inspection”	No	Not applicable. There are no copper alloy components subject to aging management review in the Steam and Power Conversion systems that are exposed to lubricating oil.
3.4.1-44	Stainless steel Piping, piping components, and piping elements, Heat exchanger components exposed to Lubricating oil	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, “One-Time Inspection”	No	Consistent with NUREG-1801. There are no stainless steel components subject to aging management review exposed to lubricating oil in the Steam and Power Conversion systems, but

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					the Lubricating Oil Analysis program will manage loss of material for stainless steel motor oil components in the Residual Heat Removal, High Pressure Core Spray, and Low Pressure Core Spray systems, as well as stainless steel Reactor Core Isolation Cooling and Offgas systems lubricating oil components. Additionally, the specific environment for components in the Offgas system aligned to this item is NOVEC™ 7100 refrigerant, a fluorinated hydrocarbon which is similar to lubricating oil for aging management comparison. The One-Time Inspection program will be used to confirm the effectiveness of the Lubricating Oil Analysis program. Stainless steel heat exchanger and piping, piping components and piping elements subject to aging management exposed to lubricating oil are also addressed in Items 3.2.1-51 and 3.3.1-100.
3.4.1-45	PWR only				
3.4.1-46	PWR only				

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-47 (LR-ISG-2011-03)	Steel (with coating or wrapping), stainless steel, nickel-alloy piping, piping components, and piping elements; tanks exposed to Soil or Concrete	Loss of material due to general (steel only), pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. The Buried and Underground Piping and Tanks program will manage loss of material for piping, piping components and piping elements subject to aging management in the Steam and Power Conversion systems exposed to soil. Loss of material for the steel Condensate Storage Tank exposed to soil is addressed in item 3.4.1-30 and bolting exposed to soil is addressed in 3.4.1-50. There are no other steel (with coating or wrapping), stainless steel or nickel alloy piping, piping components, and piping elements or tanks subject to aging management review in the Steam and Power Conversion systems that are exposed to soil or concrete (buried).
3.4.1-48 (LR-ISG-2011-03)	Stainless steel, nickel alloy bolting exposed to soil	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There is no stainless steel bolting subject to aging management review in the Steam and Power Conversion systems that is exposed to soil.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-49 (LR-ISG-2011-03)	Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not Applicable. There are no nickel alloy components subject to aging management exposed to soil or concrete. See items 3.3.1-107, 3.3.1-128 and 3.4.1-47 for management of stainless steel components subject to aging management review and exposed to soil. Stainless steel piping subject to aging management review that are embedded in concrete and in the Steam and Power Conversion systems are within structures. They are not buried and have no aging effects. See item 3.4.1-58.
3.4.1-50	Steel Bolting exposed to Soil	Loss of material due to general, pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. The Buried and Underground Piping and Tanks program will manage loss of material for steel bolting subject to aging management in the Steam and Power Conversion systems exposed to soil.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-50x (LR-ISG-2011-03)	Underground stainless steel, nickel alloy, steel piping, piping components, and piping elements	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable. There are no underground stainless steel, nickel alloy or steel piping, piping components, and piping elements subject to aging management review in the Steam and Power Conversion systems.
3.4.1-51	Steel Piping, piping components, and piping elements exposed to Concrete	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Not applicable. There are no steel components subject to aging management review in the Steam and Power Conversion systems that are exposed to concrete.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-52	Aluminum Piping, piping components, and piping elements exposed to Gas, Air – indoor, uncontrolled (Internal/External)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. There are no aluminum components subject to aging management review in the Steam and Power Conversion systems that are exposed to gas. The turbine rupture discs are aluminum and installed in the Low Pressure Turbine exhaust hood and exposed to an air – indoor, uncontrolled environment (External). No credit is taken for its external elastomer cover and there are no other aluminum components subject to aging management in the Steam and Power Conversion systems exposed to an air -indoor uncontrolled environment.
3.4.1-53	PWR only				

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-54	Copper alloy Piping, piping components, and piping elements exposed to Gas, Air – indoor, uncontrolled (External)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. Copper alloy components subject to aging management in the Steam and Power Conversion System exposed to air-indoor, uncontrolled are aligned with this item. There are no Copper alloy components subject to aging management in the Steam and Power Conversion System exposed to gas.
3.4.1-55	Glass Piping elements exposed to Lubricating oil, Air – outdoor, Condensation (Internal/External), Raw water, Treated water, Air with borated water leakage, Gas, Closed-cycle cooling water, Air – indoor, uncontrolled (External)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. Glass piping elements are only exposed to air-indoor, uncontrolled and treated water in the Steam and Power Conversion systems and are aligned to this item. In addition to the Steam and Power Conversion systems, civil commodities exposed to air-indoor, uncontrolled in the Bulk Civil Commodities, Containment Structure, and Turbine Bldgs and Associated Structures, Process Facilities, and Yard Structures are aligned to this item.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-56	Nickel alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External)	None	None	NA - No AEM or AMP	Not applicable. There are no nickel alloy components subject to aging management review in the Steam and Power Conversion systems that are exposed to air – indoor, uncontrolled.
3.4.1-57	Nickel alloy, PVC Piping, piping components, and piping elements exposed to Air with borated water leakage, Air – indoor, uncontrolled, Condensation (Internal)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. Polyvinylidene fluoride (PVDF) is considered an equivalent material for this comparison for components in the Emergency Service Water Chlorination system. PVC piping, piping components and piping elements in the Steam and Power Conversion systems subject to aging management exposed to an external air-indoor, uncontrolled environment is aligned to this item. There are no PVC components subject to aging management in the Steam and Power Conversion systems with an internal condensation environment and there are no Nickel alloy components subject to aging management in the Steam and Power Conversion systems.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-58	Stainless steel Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External), Concrete, Gas, Air – indoor, uncontrolled (Internal)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. Stainless steel piping, piping components and piping elements and a Tank subject to aging management in the Steam and Power Conversion systems exposed to air-indoor, uncontrolled and concrete are aligned with this item. There are no stainless steel piping, piping components and piping elements subject to aging management exposed gas or air-indoor, uncontrolled (internal) in the Steam and Power Conversion systems. In addition to the Steam and Power Conversion systems, Stainless steel piping, piping components and piping elements subject to aging management in the Div. 1 & 2 Standby Diesel Generator Exhaust, Intake and Crankcase system and exposed to air-indoor, uncontrolled are aligned with this item.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-59	Steel Piping, piping components, and piping elements exposed to Air – indoor controlled (External), Gas	None	None	NA - No AEM or AMP	Not applicable. There are no steel components subject to aging management review in the Steam and Power Conversion systems that are exposed to air – indoor, controlled or gas.
3.4.1-60 (LR-ISG-2012-01)	Any material, piping, piping components, and piping elements exposed to treated water	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Not applicable. Loss of material due to flow-accelerated corrosion is addressed in items 3.4.1-5, 3.4.1-14 and 3.4.1-15. Erosion has not been identified by plant OE review in the Steam and Power Conversion systems.
3.4.1-61 (LR-ISG-2012-02)	Metallic piping, piping components, and tanks exposed to raw water or waste water	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion	Yes, plant-specific (See subsection 3.4.2.2.6)	Not applicable. For metallic components subject to aging management review exposed to waste water in the Steam and Power Conversion systems see items 3.3.1-91 and 3.3.1-95, and for the condenser tubesheet exposed to raw water, see item 3.4.1-19. See further evaluation topic 3.4.2.2.6.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-62 (LR-ISG-2012-02)	Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, “Aboveground Metallic Tanks”) exposed to treated Water	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not applicable. The only tank within the scope of the Aboveground Metallic Tanks program is the Condensate Storage Tank. Loss of material for this internally-coated steel tank exposed to Treated water is addressed in item 3.4.1-67.
3.4.1-63 (LR-ISG-2012-02)	Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor	Loss of material due to general (steel, and copper alloy), pitting, or crevice corrosion, and cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only)	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, “Aboveground Metallic Tanks” (for tanks only)	No	Consistent with NUREG-1801 (as modified by LR-ISG-2012-02). The External Surfaces Monitoring of Mechanical Components program will manage loss of material for insulated steel and stainless steel piping components exposed to air - outdoor, and will manage cracking of insulated stainless steel piping components exposed to air - outdoor. The Aboveground Metallic Tanks program will manage loss of material of the insulated steel Condensate Storage Tank exposed to air - outdoor. No other piping components subject to aging management review in the Steam and Power Conversion systems are exposed to an external environment of air - outdoor or condensation.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-64 (LR-ISG-2012-02)	Jacketed calcium silicate or fiberglass insulation in an air-indoor uncontrolled or air-outdoor environment	Reduced thermal insulation resistance due to moisture intrusion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not Applicable. This item is not used in the Steam and Power Conversion Systems. There are no Jacketed calcium silicate or fiberglass insulation subject to aging management with an intended function of thermal insulation in the Bulk Civil Commodities.
3.4.1-65 (LR-ISG-2012-02)	Jacketed foamglas ® (glass dust) insulation in an air-indoor uncontrolled or air-outdoor environment	Reduced thermal insulation resistance due to moisture intrusion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not applicable. This item is not used in the Steam and Power Conversion Systems. There are no foamglas® insulation components with an intended function of thermal insulation in the Steam and Power Conversion systems.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-66 (LR-ISG-2013-01)	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physidcal damage, and spalling for cementitious coating/linings.	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2013-01). The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program will manage loss of coating or lining integrity for the Condensate Storage Tank exposed to treated water. No other internally coated or lined metallic piping, piping components, heat exchangers, or tanks subject to aging management review are in the Steam and Power Conversion systems.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-67 (LR-ISG-2013-01)	Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leasds to corrosion	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Consistent with NUREG-1801 (as modified by LR-ISG-2013-01). The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks program will manage loss of material for the Condensate Storage Tank exposed to treated water. No other internally coated or lined metallic piping, piping components, heat exchangers, or tanks subject to aging management review are in the Steam and Power Conversion systems.
3.4.1-68 (LR-ISG-2013-01)	Gray cast iron piping component with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not applicable. No internally coated or lined gray cast iron components subject to aging management review have been identified in the Steam and Power Conversion systems.

Table 3.4.2-1
Steam and Power Conversion Systems – Auxiliary Steam and Drains
Summary of Aging Management Evaluation

Table 3.4.2-1 Auxiliary Steam and Drains System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
3	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
4	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
5	Piping	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
6	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.E.S-16	3.4.1-5	A
7	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.B2.SP-73	3.4.1-14	B
8	Strainer body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-1 Auxiliary Steam and Drains System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Strainer body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
10	Strainer body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.B2.SP-73	3.4.1-14	B
11	Trap body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
12	Trap body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
13	Trap body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.B2.SP-73	3.4.1-14	B
14	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
15	Valve body	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
16	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.E.S-16	3.4.1-5	A
17	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.B2.SP-73	3.4.1-14	B

Table 3.4.2-2
Steam and Power Conversion Systems – Condensate
Summary of Aging Management Evaluation

Table 3.4.2-2 - Condensate System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
3	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
4	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
5	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
6	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-73	3.4.1-14	B
7	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
8	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-73	3.4.1-14	B

Table 3.4.2-3
Steam and Power Conversion Systems – Condensate Transfer and Storage
Summary of Aging Management Evaluation

Table 3.4.2-3 - Condensate Transfer and Storage System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
5	Bolting	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-82	3.4.1-8	A
6	Bolting	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-151	3.4.1-10	A
7	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VIII.H.SP-141	3.4.1-50	A
8	Bolting	Pressure boundary	Steel	Soil (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-142	3.4.1-6	A
9	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A

Table 3.4.2-3 - Condensate Transfer and Storage System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
11	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
12	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-73	3.4.1-14	B
13	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
14	Piping	Pressure boundary	Stainless steel	Air – outdoor (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	VIII.E.S-402 (LR-ISG-2012-02)	3.4.1-63	A
15	Piping	Pressure boundary	Stainless steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.E.S-402 (LR-ISG-2012-02)	3.4.1-63	A
16	Piping	Pressure boundary	Stainless steel	Soil (Ext)	Loss of material	Buried and Underground Piping and Tanks	VIII.E.SP-145 (LR-ISG-2011-03)	3.4.1-47	A
17	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B

Table 3.4.2-3 - Condensate Transfer and Storage System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
18	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
19	Piping	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.E.S-402 (LR-ISG-2012-02)	3.4.1-63	A
20	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-73	3.4.1-14	B
21	Tank	Pressure boundary	Steel with internal coating/lining	Air – outdoor (Ext)	Loss of material	Aboveground Metallic Tanks	VIII.E.S-31	3.4.1-29	A
22	Tank	Pressure boundary	Steel with internal coating/lining	Soil (Ext)	Loss of material	Aboveground Metallic Tanks	VIII.E.SP-115	3.4.1-30	A
23	Tank	Pressure boundary	Steel with internal coating/lining	Treated water (Int)	Loss of coating or lining integrity	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VIII.E.S-401 (LR-ISG-2013-01	3.4.1-66	A
24	Tank	Pressure boundary	Steel with internal coating/lining	Treated water (Int)	Loss of material	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	VIII.E.S-414 (LR-ISG-2013-01	3.4.1-67	A

Table 3.4.2-3 - Condensate Transfer and Storage System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
25	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
26	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
27	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
28	Valve body	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-73	3.4.1-14	B
29	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
30	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
31	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
32	Valve body	Pressure boundary	Steel	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.E.S-402 (LR-ISG-2012-02)	3.4.1-63	A

Table 3.4.2-3 - Condensate Transfer and Storage System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
33	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-73	3.4.1-14	B

Table 3.4.2-4
Steam and Power Conversion Systems – Control Rod Drive Rebuild Equipment
Summary of Aging Management Evaluation

Table 3.4.2-4 - Control Rod Drive Rebuild Equipment System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
3	Filter housing	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
4	Filter housing	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
5	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
6	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
7	Pressure reducer	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
8	Pressure reducer	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
9	Tank	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A

Table 3.4.2-4 - Control Rod Drive Rebuild Equipment System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Tank	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-75	3.4.1-12	B
11	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
12	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B

Table 3.4.2-5
Steam and Power Conversion Systems – Extraction Steam
Summary of Aging Management Evaluation

Table 3.4.2-5 – Extraction Steam Ssystem									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
No Components Subject to Aging Management Review									

Table 3.4.2-6
Steam and Power Conversion Systems – Feed Water Control, Feedwater and Feedwater Leakage Control
Summary of Aging Management Evaluation

Table 3.4.2-6 – Feed Water Control, Feedwater and Feedwater Leakage Control Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
2	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
3	Flow element	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
4	Flow element	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
5	Flow element	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
6	Flow element	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A
7	Flow element	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
8	Flow element	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-73	3.4.1-14	B
9	Heat exchanger (Channel)	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-6 – Feed Water Control, Feedwater and Feedwater Leakage Control Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Heat exchanger (Channel)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	C, 405
11	Heat exchanger (Channel)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-77	3.4.1-15	B
12	Heat exchanger (Tube)	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Ext)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	D, 405
13	Heat exchanger (Tube)	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	D, 405
14	Heat exchanger (Tube)	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Ext)	Cumulative fatigue damage	TLAA	VII.E4.A-62	3.3.1-2	C, 405
15	Heat exchanger (Tube)	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E4.A-62	3.3.1-2	C, 405
16	Heat exchanger (Tube)	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-80	3.4.1-16	B
17	Heat exchanger (Tube)	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-80	3.4.1-16	B
18	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Treated water (Ext)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	C, 405
19	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	C, 405

Table 3.4.2-6 – Feed Water Control, Feedwater and Feedwater Leakage Control Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
20	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-77	3.4.1-15	B
21	Heat exchanger (Tubesheet)	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-77	3.4.1-15	B
22	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
23	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
24	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
25	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
26	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
27	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A
28	Piping	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
29	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-6 – Feed Water Control, Feedwater and Feedwater Leakage Control Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
30	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A
31	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
32	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-73	3.4.1-14	B
33	Pump casing	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
34	Pump casing	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
35	Pump casing	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
36	Pump casing	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E4.A-62	3.3.1-2	A
37	Pump casing	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
38	Sample Probe	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
39	Sample Probe	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B

Table 3.4.2-6 – Feed Water Control, Feedwater and Feedwater Leakage Control Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
40	Sample Probe	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E4.A-62	3.3.1-2	A
41	Sample Probe	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
42	Thermal sleeve	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A
43	Thermal sleeve	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
44	Thermal sleeve	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-73	3.4.1-14	B
45	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
46	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
47	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
48	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E4.A-62	3.3.1-2	A
49	Valve body	Pressure boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B

Table 3.4.2-6 – Feed Water Control, Feedwater and Feedwater Leakage Control Systems									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
50	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
51	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.D2.S-11	3.4.1-1	A
52	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
53	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-73	3.4.1-14	B

Table 3.4.2-7
Steam and Power Conversion Systems – Main Condenser (including main turbine shell)
Summary of Aging Management Evaluation

Table 3.4.2-7 - Main Condenser (including main turbine shell)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bellows (Air Removal Pipe Connection)	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
2	Bellows (Air Removal Pipe Connection)	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Int)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
5	Condenser (Tubesheet)	Structural support	Steel	Raw water (Ext)	Loss of material	Open-Cycle Cooling Water System	VIII.E.SP-146	3.4.1-19	C, 403
6	Condenser (Tubesheet)	Structural support	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15	3.4.1-5	C, 403
7	Condenser (Tubesheet)	Structural support	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-77	3.4.1-15	D, 404
8	Condenser manway cover	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-7 - Main Condenser (including main turbine shell)

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Condenser manway cover	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15	3.4.1-5	C, 403
10	Condenser manway cover	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.A.SP-71	3.4.1-14	D, 403
11	Condenser Shell	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
12	Condenser Shell	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15	3.4.1-5	C, 403
13	Condenser Shell	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.A.SP-71	3.4.1-14	D, 403
14	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
15	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.A.SP-71	3.4.1-14	B
16	Rupture disc	Pressure boundary	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-93	3.4.1-52	C
17	Rupture disc	Pressure boundary	Aluminum	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-90	3.4.1-16	D, 406

Table 3.4.2-7 - Main Condenser (including main turbine shell)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
18	Turbine casing	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
19	Turbine casing	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.A.SP-71	3.4.1-14	D, 403

Table 3.4.2-8
Steam and Power Conversion Systems – Main and Reheat Steam
Summary of Aging Management Evaluation

Table 3.4.2-8 - Main and Reheat Steam System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A
2	Bolting	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
6	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
7	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cracking	Water Chemistry and One-Time Inspection	VIII.E.SP-88	3.4.1-11	B
8	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Cumulative fatigue damage	TLAA	VII.E3.A-62	3.3.1-2	A

Table 3.4.2-8 - Main and Reheat Steam System

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
9	Piping	Leakage boundary	Stainless steel	Treated water >60°C (>140°F) (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
10	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
11	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
12	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2.S-15	3.4.1-5	A, 401
13	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.B2.SP-73	3.4.1-14	B
14	Piping	Structural integrity	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
15	Piping	Structural integrity	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
16	Piping	Structural integrity	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2.S-15	3.4.1-5	A, 401
17	Piping	Structural integrity	Steel	Treated water (Int)	Loss of material	Water Chemistry and	VIII.B2.SP-73	3.4.1-14	B

Table 3.4.2-8 - Main and Reheat Steam System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
						One-Time Inspection			
18	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
19	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
20	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2.S-15	3.4.1-5	A, 401
21	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.B2.SP-73	3.4.1-14	B

Table 3.4.2-9
Steam and Power Conversion Systems – Main, Reheat, Extraction, and Miscellaneous Drain
Summary of Aging Management Evaluation

Table 3.4.2-9 - Main, Reheat, Extraction, and Miscellaneous Drains System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
3	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	IV.C1.RP-44	3.1.1-11	A
5	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
6	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
7	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
8	Piping	Leakage boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
9	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.E.S-16	3.4.1-5	A

Table 3.4.2-9 - Main, Reheat, Extraction, and Miscellaneous Drains System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Piping	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.C.SP-73	3.4.1-14	B
11	Piping	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
12	Piping	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
13	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.E.S-16	3.4.1-5	A
14	Piping	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.C.SP-73	3.4.1-14	B
15	Valve body	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
16	Valve body	Pressure boundary	Steel	Treated water (Int)	Cumulative fatigue damage	TLAA	VIII.B2.S-08	3.4.1-1	A
17	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Flow-Accelerated Corrosion	VIII.E.S-16	3.4.1-5	A
18	Valve body	Pressure boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.C.SP-73	3.4.1-14	B

Table 3.4.2-10
Steam and Power Conversion Systems – Respirator Cleaning
Summary of Aging Management Evaluation

Table 3.4.2-10 - Respirator Cleaning System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
3	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
4	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
5	Piping	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
6	Piping	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
7	Tank (Air hood sink)	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
8	Tank (Air hood sink)	Leakage boundary	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and	VII.E5.AP-278	3.3.1-95	A

Table 3.4.2-10 - Respirator Cleaning System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
						Ducting Components			
9	Valve body	Leakage boundary	Copper alloy >15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-6	3.4.1-54	A
10	Valve body	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	B
11	Valve body	Leakage boundary	Copper alloy >15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.A.SP-101	3.4.1-16	B
12	Valve body	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A
13	Valve body	Leakage boundary	Steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.4.2-11
Steam and Power Conversion Systems – Service Water and Emergency Service Water Chlorination
Summary of Aging Management Evaluation

Table 3.4.2-11 - Service Water and Emergency Service Water Chlorination System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
3	Piping	Leakage boundary	Polymers	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-152	3.4.1-57	A, 402
4	Piping	Leakage boundary	Polymers	Treated water (Int)	None	None	N/A	N/A	F, 402
5	Sight glass	Leakage boundary	Glass	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-9	3.4.1-55	A
6	Sight glass	Leakage boundary	Glass	Treated water (Int)	None	None	VIII.I.SP-35	3.4.1-55	A
7	Sight glass (Body)	Leakage boundary	Polymers	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-152	3.4.1-57	A, 402
8	Sight glass (Body)	Leakage boundary	Polymers	Treated water (Int)	None	None	N/A	N/A	F, 402
9	Strainer body	Leakage boundary	Polymers	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-152	3.4.1-57	A, 402
10	Strainer body	Leakage boundary	Polymers	Treated water (Int)	None	None	N/A	N/A	G, 402
11	Valve body	Leakage boundary	Polymers	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-152	3.4.1-57	A, 402

Table 3.4.2-11 - Service Water and Emergency Service Water Chlorination System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
12	Valve body	Leakage boundary	Polymers	Treated water (Int)	None	None	N/A	N/A	F, 402

Table 3.4.2-12
Steam and Power Conversion Systems – Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution
Summary of Aging Management Evaluation

Table 3.4.2-12 - Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
2	Bolting	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
3	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	A
4	Bolting	Pressure boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	A
5	Piping	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
6	Piping	Leakage boundary	Stainless steel	Concrete (Ext)	None	None	VIII.I.SP-13	3.4.1-58	A
7	Piping	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
8	Piping	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
9	Piping	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B

Table 3.4.2-12 - Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
10	Sink	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
11	Sink	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
12	Valve body	Leakage boundary	Copper alloy <15% Zn	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-6	3.4.1-54	A
13	Valve body	Leakage boundary	Copper alloy <15% Zn	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.A.SP-101	3.4.1-16	B
14	Valve body	Leakage boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
15	Valve body	Leakage boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
16	Valve body	Pressure boundary	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-12	3.4.1-58	A
17	Valve body	Pressure boundary	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-87	3.4.1-16	B
18	Water heater	Leakage boundary	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-12 - Two Bed Demineralizer and Distribution and Mixed Bed Demineralizer and Distribution System									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
19	Water heater	Leakage boundary	Steel	Treated water (Int)	Loss of material	Water Chemistry and One-Time Inspection	VIII.E.SP-75	3.4.1-12	B

Notes for Table 3.4.2-1 through Table 3.4.2-12

Standard Notes

A Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.

B Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.

D Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F Material not in NUREG-1801 for this component.

G Environment not in NUREG-1801 for this component and material.

H Aging effect not in NUREG-1801 for this component, material, and environment combination.

I Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J Neither the component nor the material and environment combination are evaluated in NUREG-1801.

Plant-Specific Notes

401 The PNPP "Treated water" environment includes the steam phase.

402 Based on plant operating experience, there are no aging effects requiring management for the Service Water and Emergency Service Water Chlorination system polymer components in a treated water or air – indoor uncontrolled environment. The materials are polyvinylidene fluoride (PVDF) and polyvinyl chloride (PVC), and the treated water environment is sodium hypochlorite at a concentration of 12% to 15%. This material is not expected to experience aging effects unless exposed to elevated temperatures or radiation levels capable of attacking the specific chemical composition. The material in these environments is not expected to experience significant aging effects due to elevated temperatures or radiation levels.

403 The Main Condenser pressure boundary and internal structural components are also aligned with this item.

404 The component is the Main Condenser tubesheet serving a structural support intended function.

405 The FW Heaters 6A and 6B tubes are aligned with this item to support the Pressure boundary Intended function.

Plant-Specific Notes (Continued)

406 Rupture disc is positioned on the exhaust hood in a location not subject to high velocity low temperature steam and subject to condenser pressure.

3.5 AGING MANAGEMENT OF CONTAINMENTS, STRUCTURES, AND COMPONENT SUPPORTS

3.5.1 INTRODUCTION

This section provides the results of the aging management review for those structural components identified in Section 2.4.1, Structures and Component Supports, as being subject to aging management review. The following structures and commodity groups are addressed in this section, and are described in the indicated sections.

- Containment Structure, Unit 1 (includes reactor building and containment vessel) (Section 2.4.1)
- Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures (Section 2.4.2)
- Water Control Structures (Section 2.4.3)
- Structural Bulk Commodities (Section 2.4.4)

3.5.2 RESULTS

The following tables summarize the results of the aging management review for Structures.

- Table 3.5.2-1 Containment Structure, Unit 1 (includes the reactor building and containment vessel)
- Table 3.5.2-2 Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures
- Table 3.5.2-3 Water Control Structures
- Table 3.5.2-4 Bulk Commodities

3.5.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for structures and component supports subject to aging management review. Programs are described in Appendix B. Further details are provided in the structures and commodities tables.

3.5.2.1.1 Containment Structure, Unit 1 (includes the reactor building and containment vessel)

Materials

The Containment Structure components are constructed of the following materials:

- Aluminum
- Coatings
- Concrete
- Copper alloy <15% Zn
- Elastomer
- Fiberglass
- Fiberglass fabric
- Glass
- Porous concrete
- Stainless steel
- Steel
- Steel with stainless steel cladding

Environments

The Containment Structure components are exposed to the following environments:

- Air - dry
- Air – indoor, uncontrolled
- Air – outdoor
- Concrete
- Gas
- Raw water
- Soil
- Treated water

- Waste water

Aging effects Requiring Management

The following aging effects associated with the Containment Structure require management:

- Change in material properties
- Cracking
- Cumulative fatigue damage
- Loss of coating integrity
- Loss of material
- Loss of material (Corrosion of embedded steel reinforcing)
- Loss of preload
- Loss of sealing

Aging Management Programs

The following aging management programs manage the effects of aging on the Containment Structure components:

- 10 CFR 50, Appendix J (B.2.1)
- ASME Section XI, Subsection IWE (B.2.4)
- ASME Section XI, Subsection IWF (B.2.5)
- ASME Section XI, Subsection IWL (B.2.6)
- Fire Protection (B.2.20)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (B.2.26)
- One-Time Inspection (B.2.35)
- Protective Coating Monitoring and Maintenance (B.2.38)
- Structures Monitoring (B.2.43)
- TLAA
- Water Chemistry (B.2.44)

3.5.2.1.2 Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures

Materials

The Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures components are constructed of the following materials:

- Aluminum
- Concrete
- Concrete Block
- Galvanized steel
- Glass
- Porous concrete
- Stainless steel
- Steel

Environments

The Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Concrete
- Raw water
- Soil
- Treated water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures require management:

- Change in material properties
- Cracking
- Cumulative fatigue damage
- Loss of material
- Loss of material (Corrosion of embedded steel reinforcing)

Aging Management Programs

The following aging management programs manage the effects of aging on the Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures components:

- Fire Protection (B.2.20)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.25)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (B.2.26)
- One-Time Inspection (B.2.35)
- Structures Monitoring (B.2.43)
- TLAA
- Water Chemistry (B.2.44)

3.5.2.1.3 Water Control Structures

Materials

The Water Control Structures components are constructed of the following materials:

- Concrete
- Elastomer
- Galvanized steel
- Porous concrete
- Rock/Stone/Soil
- Stainless Steel
- Steel

Environments

The Water Control Structures components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects associated with the Water Control Structures require management:

- Change in material properties
- Cracking
- Cumulative fatigue damage
- Flow blockage
- Loss of form
- Loss of material
- Loss of material (Corrosion of embedded steel reinforcing)
- Loss of sealing

Aging Management Programs

The following aging management programs manage the effects of aging on the Water Control Structures components:

- Fire Protection (B.2.20)
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (B.2.41)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (B.2.26)
- Structures Monitoring (B.2.43)
- TLAA

3.5.2.1.4 Bulk Commodities

Materials

The Bulk Commodities components are constructed of the following materials:

- 3M Interam®
- Aluminum
- Concrete
- Elastomer
- Fiberglass/ Alumina silicate/ Calcium silicate/ Ceramic fiber
- Fiberglass Fabric
- Galvanized steel
- Glass

- High strength steel
- Lubrite®/ Fluorogold®
- Polymer
- Porcelain
- Pyrocrete
- Stainless steel
- Steel
- Wood

Environments

The Bulk Commodities components are exposed to the following environments:

- Air – indoor, uncontrolled
- Air – outdoor
- Concrete
- Diesel Exhaust
- Raw water
- Soil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Bulk Commodities require management:

- Change in material properties
- Cracking
- Delamination
- Flow Blockage
- Loss of material
- Loss of material (Corrosion of embedded steel reinforcing)
- Loss of mechanical function
- Loss of preload
- Loss of sealing
- Loss of Strength

Aging Management Programs

The following aging management programs manage the effects of aging on the Bulk Commodities components:

- ASME Section XI, Subsection IWF (B.2.5)
- External Surfaces Monitoring of Mechanical Components (B.2.18)
- Fire Protection (B.2.20)
- One-Time Inspection (B.2.35)
- RG 1.127 – Inspection of Water-Control Structures Associated with Nuclear Power Plants (B.2.41)
- Structures Monitoring (B.2.43)
- Water Chemistry (B.2.44)

3.5.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.5.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the PNPP approach to these areas requiring further evaluation. Programs are described in Appendix B.

Note - Italicized text at the beginning of each Further Evaluation subsection is taken directly from NUREG-1800 as supplemented by LR-ISG-2011-04 and LR-ISG-2011-05.

3.5.2.2.1 PWR and BWR Containments

3.5.2.2.1.1 Cracking and Distortion due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, and Cracking due to Differential Settlement and Erosion of Porous Concrete Subfoundations.

Cracking and distortion due to increased stress levels from settlement could occur in PWR and BWR concrete and steel containments. The existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. Also, reduction of foundation strength and cracking, due to differential settlement and erosion of porous concrete sub foundations could occur in all types of PWR and BWR containments. The existing program relies on the structures monitoring program to manage these aging effects. However, some plants may rely on a dewatering system to lower the site ground water level. If the plant's current licensing basis (CLB) credits a de-watering system to control settlement, the GALL Report recommends further evaluation to verify the continued functionality of the de-watering system during the period of extended operation.

PNPP does not rely on a dewatering system for control of settlement. But plant substructures were designed with porous concrete and a permanent underdrain system to reduce hydrostatic pressure. The Reactor Building is founded on Chagrin shale. Chagrin shale is bedrock with a maximum total expected settlement between 1/3 and ½ inch. Differential settlement between safety-related and nonsafety-related structures can affect safety-related structures. However, the nonsafety-related structures adjacent to safety-related structures are also founded on bedrock. The Structures Monitoring Program includes monitoring the settlement and rebound of structures. Measured settlement has been minimal. The PNPP below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Reviews of PNPP OE have not identified any aging effects that resulted from an aggressive below-grade environment. As a result, cracking and distortion due to increased stress level from settlement; reduction of foundation strength, and cracking due to differential settlement and erosion of the porous concrete subfoundation are not aging effects requiring management for the PNPP concrete containment basemat. The absence of concrete aging effects is confirmed under the Containment Inservice Inspection – IWL program.

3.5.2.2.1.2 Reduction of Strength and Modulus due to Elevated Temperature

Reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR concrete and steel containments. The implementation of 10 CFR 50.55a and ASME Section XI, Subsection IWL would not be able to identify the reduction of strength and modulus of concrete due to elevated temperature. Subsection CC-3440 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period. The GALL Report recommends further evaluation of a plant-specific aging management program if any portion of the concrete containment components exceeds specified temperature limits, i.e., general area temperature greater than 66°C (150°F) and local area temperature greater than 93°C (200°F). Higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

During normal operation, areas within containment are maintained at or below an average temperature of 95°F. For Mark III steel containments, this GALL item applies to the containment basemat and the concrete fill-in annulus. Since those components are in the lower elevations of the containment structure, they will be below the average temperature. Therefore, change in material properties due to elevated temperature is not an aging effect requiring management for containment concrete. Concrete aging is managed by the ASME Section XI, Subsection IWL and Structures Monitoring programs as described in other Table 3.5.1 items.

3.5.2.2.1.3 Loss of Material due to General, Pitting and Crevice Corrosion

1. *Loss of material due to general, pitting, and crevice corrosion could occur in steel elements of inaccessible areas for all types of PWR and BWR containments. The existing program relies on ASME Section XI, Subsection*

IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect if corrosion is indicated from the IWE examinations. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR). Loss of material due to general, pitting, and crevice corrosion could occur in steel elements of inaccessible areas for all types of PWR and BWR containments.

PNPP has a Mark III containment structure constructed with a reinforced concrete shield building enclosing a free standing steel containment vessel and does not have a drywell shell, embedded shell or region shielded by diaphragm floors. To prevent corrosion of the inaccessible areas of the lower portion (basemat area) of the containment liner plate, the interior and exterior surfaces are protected from contact with the atmosphere by complete concrete encasement. It is not credible for ground water to reach this portion of the liner plate, assuming a crack in the concrete, since the basemat concrete at this location is greater than five feet thick and poured in multiple horizontal planes. Additionally a waterproof membrane and work-slab is constructed below this area. Therefore, corrosion of the liner plate is not expected. Interior concrete is monitored for cracks under the Structures Monitoring program. The steel containment vessel and areas where the steel vessel becomes embedded in the concrete floor are inspected in accordance with the ASME Section XI, Subsection IWE and Structures Monitoring programs. Therefore, no additional plant specific activities are warranted.

2. *Loss of material due to general, pitting, and crevice corrosion could occur in steel torus shell of Mark I containments. The existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect if corrosion is significant. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).*

PNPP has a Mark III steel containment, enclosed by a reinforced concrete cylinder. Therefore, loss of material due to general, pitting, and crevice corrosion which may occur in the steel torus shell of Mark I containments does not apply.

3. *Loss of material due to general, pitting, and crevice corrosion could occur in steel torus ring girders and downcomers of Mark I containments, downcomers of Mark II containments, and interior surface of suppression chamber shell of Mark III containments. The existing program relies on ASME Section XI, Subsection IWE to manage this aging effect. The GALL Report recommends further evaluation of plant specific programs to manage this aging effect if corrosion is significant. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRPLR).*

PNPP is a Mark III steel containment, enclosed by a reinforced concrete cylinder. PNPP is a BWR Mark Ill with a free-standing steel containment vessel (SCV) with a suppression pool chamber whose floor and outer wall are integral to the SCV. The portion of the SCV outer wall exposed to the suppression pool is clad with stainless steel. Therefore, the carbon steel SCV is not exposed to the suppression pool water environment. The interior surfaces of the suppression chamber that is integral to the SCV, including the stainless steel cladding, are inspected in accordance with the requirements of Subsection IWE of the ASME Code Section XI.

Therefore, loss of material due to general, pitting, and crevice corrosion to the carbon steel surface of the suppression chamber is not an aging effect requiring management for the interior surfaces of the suppression pool that is integral to the SCV, because it is lined with stainless steel. However, the Containment lnservice Inspection - IWE Program manages loss of material due to general, pitting, and crevice corrosion for the stainless steel clad portion of the interior surfaces of suppression chamber that is integral to the SCV.

3.5.2.2.1.4 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

Loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments is a Time-Limited Aging Analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.5, "Concrete Containment Tendon Prestress Analysis," of this SRP-LR.

The PNPP containment is a steel vessel enclosed by a reinforced concrete cylindrical structure (not prestressed). Therefore, loss of prestress due to relaxation, shrinkage, creep, and elevated temperature does not apply.

3.5.2.2.1.5 Cumulative Fatigue Damage

If included in the current licensing basis, fatigue analyses of suppression pool steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) for all types of PWR and BWR containments and BWR vent header, vent line bellows, and downcomers are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.6, "Containment Liner Plates, Metal Containments, and Penetrations Fatigue Analysis," of this SRP-LR.

TLAAs are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4. Fatigue TLAAs for the PNPP Mark III containment vessel, bellows and welds and associated penetrations are evaluated as documented in Section 4.5. The NUREG-1801 BWR components (e.g., torus, suppression pool shell, vent line bellows, and unbraced downcomers) related to Mark I and II containments are not applicable to the PNPP Mark III containment.

3.5.2.2.1.6 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking of stainless steel penetration bellows and dissimilar metal welds could occur in all types of PWR and BWR containments. The existing program relies on ASME Section XI, Subsection IWE and10 CFR Part 50,

Appendix J, to manage this aging effect. The GALL Report recommends further evaluation of additional appropriate examinations/evaluations implemented to detect these aging effects for stainless steel penetration bellows and dissimilar metal welds.

NUREG-1801 recommends further evaluation of inspection methods to detect cracking due to stress corrosion cracking (SCC) since visual VT-3 examinations may be unable to detect this aging effect. Potentially susceptible components at PNPP are penetration sleeves and bellows and associated welds. SCC is an aging mechanism that requires the simultaneous action of an aggressive chemical environment, sustained tensile stress, and a susceptible material. Elimination of any one of these elements will eliminate susceptibility to SCC. Stainless steel elements of containment, including dissimilar welds, are not susceptible to SCC, because, these elements are not subject to an aggressive chemical environment. A review of plant operating experience did not identify cracking of these components, and containment pressure boundary functions have not been identified as a concern. Although an aggressive chemical environment doesn't exist, the potential for SCC is assumed for these components, and the aging effect is managed by the ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J programs for containment penetrations, and by the ASME Section XI, Subsection IWE and Structures Monitoring programs for drywell mechanical penetrations.

3.5.2.2.1.7 Loss of Material (Scaling, Spalling) and Cracking due to Freeze-Thaw

Loss of material (scaling, spalling) and cracking due to freeze-thaw could occur in inaccessible areas of PWR and BWR concrete containments. The GALL Report recommends further evaluation of this aging effect for plants located in moderate to severe weathering conditions.

PNPP inaccessible and accessible concrete areas are designed in accordance with American Concrete Institute (ACI) specification ACI 318, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions. Concrete quality was determined by following guidance as specified in ACI 318 Subsection 4.2.5 and Table 4.2.5. PNPP concrete also meets requirements of guidance provided in ASTM International (ASTM) standards for selection, application and testing of concrete and concrete aggregate. Inaccessible areas are generally those below grade, where temperatures are not expected to support freeze/thaw. Therefore, loss of material (scaling, spalling) and cracking due to freeze thaw is not applicable for concrete in inaccessible areas. The absence of concrete aging effects is confirmed by the ASME Section XI, Subsection IWL and Structures Monitoring programs.

3.5.2.2.1.8 Cracking due to Expansion from Reaction with Aggregate

Cracking due to expansion from reaction with aggregates could occur in inaccessible areas of concrete elements of PWR and BWR concrete and steel containments. The GALL Report recommends further evaluation to determine if a plant-specific aging management program is required to manage this aging effect. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

PNPP containment concrete (basemat and concrete fill in annulus) is designed in accordance with specification ACI 318, Building Code Requirements for Reinforced Concrete and concrete specification requires that the potential reactivity of aggregates be tested in accordance with ASTM C 289 and ASTM C 227. Also ASTM C 295 was used to identify elements in the aggregate which may be unfavorably reactive with alkalis in cement. Concrete structures are not exposed to flowing water and the concrete used was constructed in accordance with the recommendations in ACI 318 Subsection 4.2.5 for concrete quality. Thus, cracking due to reaction with aggregates has not been observed on PNPP concrete structures, including Containment Structures. Nevertheless, the ASME Section XI, Subsection IWL program and the Structures Monitoring program will continue to inspect and monitor the concrete Containment Structures for cracking due to any mechanism. PNPP will also examine exposed portions of below-grade concrete, when excavated for any reason, in accordance with the Structures Monitoring program. Accessible concrete surfaces of the containment fill in annulus are monitored for cracking due to expansion from reaction with aggregates by the ASME Section XI, Subsection IWL program and are addressed under Item Number 3.5.1-19. The ASME Section XI, Subsection IWL program requires evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicated the presence of, or result in, degradation of such inaccessible areas. In addition, other accessible containment structure concrete is monitored for cracking due to expansion from reaction with aggregates by the Structures Monitoring program and addressed under Item Number 3.5.1-54. The Structures Monitoring program also requires evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation in such inaccessible areas. The condition of accessible and above-grade concrete is used as an indicator of the condition of the inaccessible and below-grade structural components and provides reasonable assurance that degradation of inaccessible structural components will be detected before a loss of an intended function.

PNPP structural concrete was constructed as recommended to preclude cracking due to this mechanism; therefore, no plant-specific aging management program is required. The ASME Section XI, Subsection IWL program and the Structures Monitoring program are described in Appendix B.

3.5.2.2.1.9 Increase in Porosity and Permeability due to Leaching of Calcium Hydroxide and Carbonation

Increase in porosity and permeability due to leaching of calcium hydroxide and carbonation could occur in inaccessible areas of concrete elements of PWR and BWR concrete and steel containments. The GALL Report recommends further evaluation if leaching is observed in accessible areas that impact intended functions. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

The PNPP below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Concrete was provided with at least the minimum required air content and a low water/cement ratio as specified in ACI 318. The potential for an increase in porosity and permeability due to leaching of calcium hydroxide and carbonation has been previously evaluated. Engineering evaluations performed for the OE discussed in the Aging Management Program "Structures Monitoring" concluded that the interior of the porous concrete layer (under the plant buildings) is fairly stagnant and leaching of calcium is localized in the peripheral portions of the porous concrete pad, and not uniformly throughout the pad. Therefore, this aging effect will not fail the intended function of the porous concrete, if it occurs.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

Structure groups and component support groups as used in the following discussions are defined in NUREG-1800, Section 3.5.1.

3.5.2.2.2.1 Aging Management of Inaccessible Areas

1. *Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures for plants located in moderate to severe weathering conditions.*

Aggregates used during construction were in accordance with specifications and materials conforming to ACI and ASTM standards. PNPP structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios and air entrainment percentages are within the limits provided in ACI 318. Therefore, loss of material (spalling, scaling) and cracking due to freeze thaw are not aging effects requiring management for PNPP Groups 1–3, 5, 7–9 structures. The absence of concrete aging effects is confirmed by the ASME Section XI, Subsection IWL and Structures Monitoring programs.

2. *Cracking due to expansion and reaction with aggregates could occur in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures. The GALL Report recommends further evaluation of inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in the GALL Report.*

Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction. PNPP structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/ cement ratios and air entrainment percentages were within the limits provided in ACI 318. Therefore, cracking due to expansion and reaction with aggregates for Groups 1– 5, 7–9 structures is not expected; however, this potential aging effect is managed, regardless of the mechanism that may cause the aging effect.

Cracking associated with expansion due to reaction with aggregates has not been observed in PNPP structures. Nevertheless, the Structures Monitoring program continues to inspect and monitor concrete structures for cracking due to any mechanism. Accessible concrete is monitored for cracking due to expansion from reaction with aggregates by the Structures Monitoring program that is addressed under Item Number

3.5-54. The Structures Monitoring program requires evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation of such inaccessible areas. PNPP will also examine exposed portions of below-grade concrete when excavated for any reason, in accordance with the Structures Monitoring program. The condition of accessible and above-grade concrete is used as an indicator of the condition of the inaccessible and below-grade structural components and provides reasonable assurance that degradation of inaccessible structural components will be detected before loss of an intended function. The PNPP structural concrete was constructed as recommended to preclude cracking due to this mechanism; therefore, no plant-specific aging management program or further evaluation of inaccessible below-grade concrete for this mechanism is required. The Structures Monitoring program is described in Appendix B.

Additionally, in 2014, PNPP performed petrographic examination of concrete cores from Unit 2 Auxiliary Building per ASTM C856. The concrete cores for testing were extracted horizontally from the walls. The purpose of the examination was to evaluate the overall condition of concrete, as well as to evaluate the concrete for the presence of alkali-aggregate reaction, and if present, its extent throughout the concrete. The examination indicated no evidence of alkali-aggregate reaction (either alkali-silica reaction or alkali-carbonate reaction) in the three concrete cores. No alkali-silica gel, cracks, microcracks, or aggregate reaction rims were observed. No evidence of other deleterious mechanisms (such as freeze-thaw deterioration or delayed ettringite formation) was observed in the three concrete cores.

3. *Cracking and distortion due to increased stress levels from settlement could occur in below-grade inaccessible concrete areas of structures for all Groups, and reduction in foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 -9 structures. The existing program relies on structure monitoring programs to manage these aging effects. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.*

For Groups 1–3, 5–9, support for most Seismic Category I structures is founded either on Chagrin shale or on Class A fill over lower till. Chagrin shale is bedrock with a maximum total expected settlement between 1/3 and ½ inch. Lower till is exceedingly dense with a safety factor greater than 13 against bearing capacity. Class A fill is well-consolidated fill. When the Maintenance Rule program was initiated the results of periodic settlement and rebound monitoring became part of the Maintenance Rule evaluation of plant structures. Settlement and rebound monitoring began during construction and has continued to the present. More than twenty years of settlement and rebound monitoring has revealed minimal settlement. PNPP groundwater is not aggressive. Potential total and differential settlements is addressed in the design of foundations at the site. The results of the monitoring program have demonstrated that cracks and distortion due to increased stress levels from settlement for below grade inaccessible concrete areas of structures for all groups and reduction in foundation strength, and cracking, due to differential settlement and erosion of porous concrete subfoundation in below grade inaccessible concrete areas for Groups 1–3, 5–9 structures is not an aging effect requiring management for PNPP concrete. Nonetheless, accessible concrete components will be monitored by the ASME Section XI, Subsection IWL and Structures Monitoring programs to confirm the absence of aging effects. The Structures Monitoring Program will continue to evaluate settlement and rebound measurement results.

4. *Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation could occur in below-grade inaccessible concrete areas of Groups 1-5 and 7-9 structures. The GALL Report recommends further evaluation if leaching is observed in accessible areas that impact intended functions.*

Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction to ensure concrete durability. PNPP structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. These groups of structures at PNPP use a dense low permeable concrete with an acceptable water-to-cement ratio, which provides an acceptable degree of protection against aggressive chemical attack.

The PNPP below-grade environment is not aggressive. Therefore, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation of below grade inaccessible concrete areas are not aging effects requiring management for PNPP Groups 1–5 and 7–9 concrete structures. The absence of concrete aging effects is confirmed by the ASME Section XI, Subsection IWL and Structures Monitoring programs.

3.5.2.2.2.2 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

Reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR Group 1-5 concrete structures. For any concrete elements that exceed specified temperature limits, further evaluations are recommended. Appendix A of ACI 349-85 specifies the concrete temperature limits for normal operation or any other long-term period. The temperatures shall not exceed 66°C (150°F) except for local areas, which are allowed to have increased temperatures not to exceed 93°C (200°F). The GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits, i.e., general area temperature greater than 66°C (150°F) and local area temperature greater than 93°C (200°F). Higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations. The acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

ACI 349 specifies concrete temperature limits for normal operations or any other long term period. The temperatures shall not exceed 150°F except for local areas, which are allowed to have increased temperatures not to exceed 200°F. During normal operation, primary containment average temperature is maintained at or below 95°F. Also, drywell average temperature is maintained at or below 145°F. Piping penetrations carrying hot fluid (pipe temperature > 200 degrees F) through the reactor building concrete cylinder wall use piping that is insulated as required to maintain the concrete temperature adjoining the embedded sleeve at or below 200 degrees F."

Structures outside of containment do not expose concrete to temperatures in excess of 150°F for normal operations or any other long-term period. PNPP concrete elements do not exceed the temperature limits associated with aging degradation due to elevated temperature. Therefore, reduction of strength and modulus of concrete due to elevated temperatures is not an aging effect requiring management.

3.5.2.2.2.3 Aging Management of Inaccessible Areas for Group 6 Structures

For inaccessible areas of certain Group 6 structures, aging effects are covered by inspections in accordance with the Structures Monitoring program.

1. *Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas for plants located in moderate to severe weathering conditions.*

The below grade inaccessible concrete areas of PNPP Group 6 structures were constructed in a manner that minimizes the potential for any freeze-thaw aging effects. Therefore, loss of material (spalling, scaling) and cracking due to freeze-thaw are not aging effects requiring management for PNPP Groups 6 structures. The absence of concrete aging effects is confirmed by the Structures Monitoring and RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants programs.

2. *Cracking due to expansion and reaction with aggregates could occur in below-grade inaccessible reinforced concrete areas of Group 6 structures. The GALL Report recommends further evaluation to determine if a plant-specific aging management program is required to manage this aging effect. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).*

Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction. PNPP structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/ cement ratios, and air entrainment percentages are within the limits provided in ACI 318-63. The PNPP below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, cracking due to expansion and reaction with aggregates in below grade inaccessible concrete areas of Group 6 Structures is not expected; however, this potential aging effect is managed regardless of the mechanism that caused the aging effect.

Cracking associated with expansion due to reaction with aggregates has not been observed in PNPP Group 6 structures. Nevertheless, the Regulatory Guide (RG) 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program continues to inspect and monitor Group 6 concrete structures for cracking due to any mechanism. Accessible Group 6 concrete is monitored for cracking due to expansion from reaction with aggregates by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program and is addressed under Item Number 3.5.1-54. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program requires evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation in such inaccessible areas. The condition of accessible and above-ground concrete is used as an indicator of the condition of the inaccessible and below-grade structural components and provides reasonable assurance that degradation of inaccessible structural components will be detected before a loss of an intended function. PNPP will also examine exposed portions of the below-grade concrete when excavated for any reason, in accordance with the Structures Monitoring program. PNPP structural concrete was constructed as recommended to preclude cracking due to this mechanism. Therefore, no plant-specific aging management program is required for inaccessible, below-grade, Group 6 structures for this mechanism. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program, and the Structures Monitoring program are described in Appendix B.

3. *Increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation could occur in inaccessible areas of concrete elements of Group 6 structures. The GALL Report recommends further evaluation if leaching is observed in accessible areas that impact intended functions. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).*

Below-grade exterior reinforced concrete at PNPP is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate). Therefore, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible areas of concrete elements are not aging effects requiring management for below-grade inaccessible concrete areas of PNPP Group 6 structures. The absence of concrete aging effects is confirmed under the Structures Monitoring program.

3.5.2.2.2.4 Cracking due to Stress Corrosion Cracking and Loss of Material due to Pitting and Crevice Corrosion

Cracking due to stress corrosion cracking and loss of material due to pitting and crevice corrosion could occur for Group 7 and 8 stainless steel tank liners exposed to standing water. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects. The acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

NUREG-1800 Section 3.5.2.2.2.4 applies to stainless steel liners for concrete or steel tanks. No tanks with stainless steel liners are included in the scope of license renewal. Pool and sump liners are normally below the threshold temperature for stress corrosion cracking. Loss of material for sump liners will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program as addressed in item 3.3.1-95. Loss of material for liners in treated water pools are managed by the Water Chemistry program as addressed in items 3.3.1-25 and 3.5.1-78. The One-Time Inspection program will confirm the effectiveness of the Water Chemistry program for pools in containment as addressed in item 3.3.1-25.

3.5.2.2.2.5 Cumulative Fatigue Damage due to Fatigue

Fatigue of component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports is a TLAA as defined in 10 CFR 54.3 only if a CLB fatigue analysis exists. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-LR.

TLAA are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4 of this application. During the process of identifying TLAAs in the PNPP current licensing basis, no fatigue analyses were identified for component support members, component support welds, and support anchorages to building structure for Groups B1.1, B1.2, and B1.3.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2 of this SRP-LR).

See Appendix B Section B.1.3 for discussion of PNPP quality assurance procedures and administrative controls for aging management programs.

3.5.2.2.4 Ongoing Review of Operating Experience (per LR-ISG-2011-05)

Ongoing review of operating experience is addressed in Appendix A, Section A.1 and Appendix B, Section B.1.4.

3.5.2.3 Time-Limited Aging Analysis

Potential TLAA identified for structural components and commodities include fatigue analyses for the containment vessel plate, cranes, and penetrations, and associated bellows. These topics are discussed in Section 4.6.

3.5.3 CONCLUSION

The structural components and commodities subject to aging management review have been identified in accordance with the criteria of 10 CFR 54.21. The aging management programs selected to manage the effects of aging on structural components and commodities are identified in Section 3.5.2.1 and the following tables. A description of the aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the structural components and commodities will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-1	Concrete: dome; wall; basemat; ring girders; buttresses, Concrete elements, all	Cracking and distortion due to increased stress levels from settlement	Chapter XI.S2, "ASME Section XI, Subsection IWL" or Chapter XI.S6, "Structure Monitoring" If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.1.1)	PNPP does not rely on a dewatering system for control of settlement. Perry has a free standing steel containment vessel with its base foundation founded on the reactor building's foundation mat. For further evaluation refer to section 3.5.2.2.1.1.
3.5.1-2	Concrete: foundation; subfoundation	Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation	Chapter XI.S6, "Structures Monitoring" If a de-watering system is relied upon for control of erosion, then the licensee is to ensure proper functioning of the de- watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.1.1)	A layer of porous concrete supports the PNPP reactor building foundation. However, PNPP does not rely on a dewatering system for control of settlement. For further evaluation refer to section 3.5.2.2.1.1.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-3	Concrete: dome; wall; basemat; ring girders; buttresses, Concrete: containment; wall; basemat, Concrete: basemat, concrete fill-in annulus	Reduction of strength and modulus due to elevated temperature (>150˚F general; >200˚F local)	A plant-specific aging management program is to be evaluated.	Yes, if temperature limits are exceeded (See subsection 3.5.2.2.1.2)	Perry's containment is a free-standing steel containment vessel. The concrete foundation of the containment is not exposed to general and local temperatures that exceed the thresholds. For further evaluation, see Section 3.5.2.2.1.2.
3.5.1-4	Steel elements (inaccessible areas): drywell shell; drywell head; and drywell shell	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is indicated from the IWE examinations (See subsection 3.5.2.2.1.3.1)	The PNPP Mark III containment design includes a drywell head and drywell wall. The upper drywell wall extends up to the drywell top slab. Above the drywell vent region, the inside face of the drywell is formed with a steel plate. The surface of the upper drywell wall and drywell head are considered to be accessible. For further discussion see Section 3.5.2.2.1.3 Item 1.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-5	Steel elements (inaccessible areas): liner; liner anchors; integral attachments, Steel elements (inaccessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE" and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is indicated from the IWE examinations (See subsection 3.5.2.2.1.3.1)	Consistent with NUREG-1801. PNPP is a BWR Mark III with a free-standing SCV. The Containment Inservice Inspection IWE and the Containment Leak Rate Programs manage the loss of material of steel elements in this listing. For further evaluation, see Section 3.5.2.2.1.3 Item 1.
3.5.1-6	Steel elements: torus shell	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE" and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is significant Recoating of the torus is recommended. (See subsection 3.5.2.2.1.3.2)	PNPP is a BWR Mark III with a free-standing SCV. PNPP containment does not have the listed steel element. For further discussion, see Section 3.5.2.2.1.3 Item 2.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-7	Steel elements: torus ring girders; downcomers;, Steel elements: suppression chamber shell (interior surface)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE"	Yes, if corrosion is significant (See subsection 3.5.2.2.1.3.3)	PNPP is a BWR Mark III with a free-standing SCV. The PNPP BWR containment does not have a torus ring girder or downcomers. PNPP does have a suppression chamber for the suppression pool. The suppression chamber inner surface is integral to the SCV, clad with stainless steel. Therefore, loss of material due to general, pitting and crevice corrosion related to carbon steel for this listing is not an aging effect requiring management for the SCV suppression pool. For further discussion, see Section 3.5.2.2.1.3 Item 2.
3.5.1-8	Prestressing system: tendons	Loss of prestress due to relaxation; shrinkage; creep; elevated temperature	Yes, TLAA	Yes, TLAA (See subsection 3.5.2.2.1.4)	NUREG- 1801 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. PNPP containment is a BWR Mark III steel containment and does not incorporate a prestressing system. For further evaluation, see Section 3.5.2.2.1.4.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-9	Penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, Suppression pool shell; unbraced downcomers, Steel elements: vent header; downcomers	Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists)	Yes, TLAA	Yes, TLAA (See subsection 3.5.2.2.1.5)	Consistent with NUREG-1801. Fatigue of containment penetrations is a TLAA. See sections 3.5.2.2.1.5 and 4.6.2.
3.5.1-10	Penetration sleeves; penetration bellows	Cracking due to stress corrosion cracking	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, “10 CFR Part 50, Appendix J”	Yes, detection of aging effects is to be evaluated (See subsection 3.5.2.2.1.6)	Not applicable - This table row applies to PWRs.
3.5.1-11	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557).	Yes, for plants located in moderate to severe weathering conditions (See subsection 3.5.2.2.1.7)	PNPP containment is a free-standing SCV, completely enclosed by a reinforced concrete shield building. The concrete foundation mat (basemat) of the PNPP primary containment is protected from the external environments by the reactor building's base foundation. Therefore, the concrete elements of the SCV foundation (basemat) are not subject to the listed aging effects due to freeze-thaw. For further evaluation, see Section 3.5.2.2.1.7.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-12	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): containment; wall; basemat, Concrete (inaccessible areas): basemat, concrete fill-in annulus	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated function (See subsection 3.5.2.2.1.8)	PNPP containment is a free-standing SCV completely enclosed by a reinforced concrete shield building. The SCV does not contain the listed concrete components except for its foundation, which is integral to the reactor building basemat. For further evaluation, see Section 3.5.2.2.1.8.
3.5.1-13	Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function (See subsection 3.5.2.2.1.9)	Consistent with NUREG-1801. Change in material properties is inclusive of Increase in porosity and permeability. For loss of strength due to leaching of calcium hydroxide and carbonation See further evaluation, Section 3.5.2.2.1.9.
3.5.1-14	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): containment; wall; basemat	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function (See subsection 3.5.2.2.1.9)	NUREG- 1801 items referencing this item number are associated with BWR concrete containment structures, and PNPP is an SCV. For further evaluation, see Section 3.5.2.2.1.9.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-15	Concrete (accessible areas): basemat	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S2, "ASME Section XI, Subsection IWL"	No	PNPP containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat and does not contain a basemat with accessible areas.
3.5.1-16	Concrete (accessible areas): basemat, Concrete: containment; wall; basemat	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. Aging of the porous concrete foundation will be maanged by the Structures Monitoring program.
3.5.1-17	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, "ASME Section XI, Subsection IWL"	No	The GALL components associated with this item refer to concrete containments. Perry's design is a BWR Mark III Steel containment, such that the PNPP design does not contain the listed concrete components.
3.5.1-18	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S2, "ASME Section XI, Subsection IWL"	No	PNPP containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. The reactor building basemat is not considered to be accessible.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-19	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat, Concrete (accessible areas): containment; wall; basemat, Concrete (accessible areas): basemat, concrete fill-in annulus	Cracking due to expansion from reaction with aggregates	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	PNPP containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. The reactor building basemat is not considered to be accessible. The top surface of the annulus concrete is accessible. Aging of annulus concrete will be managed by the ASME Section XI, Subsection IWL.
3.5.1-20	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): containment; wall; basemat	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	The GALL components associated with this item refer to concrete containments. Perry's design is a BWR Mark III Steel containment, such that the PNPP design does not contain the listed concrete components.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-21	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses; reinforcing steel, Concrete (accessible areas): basemat; reinforcing steel, Concrete (accessible areas): dome; wall; basemat; reinforcing steel	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S2, "ASME Section XI, Subsection IWL"	No	Consistent with NUREG-1801 with the following clarifications. The ASME Section XI, Subsection IWL program will manage cracking of the annulus concrete in Containment within the scope of the ASME program. Loss of bond and loss of material are not applicable aging effects for the annulus concrete exposed to Air-indoor, uncontrolled. The Structures Monitoring program manages cracking in concrete beams, columns, floors and interior walls in Containment that are not in the scope of ASME Section XI, Subsection IWL. See Item 3.5.1-24.
3.5.1-22	Concrete (inaccessible areas): basemat; reinforcing steel	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S6, "Structures Monitoring"	No	The GALL components associated with this item refer to BWR Mark I and II concrete containments. Perry's design is a BWR Mark III Steel containment, such that the PNPP design does not contain the listed concrete components.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-23	Concrete (inaccessible areas): basemat; reinforcing steel, Concrete (inaccessible areas): dome; wall; basemat; reinforcing steel	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring program will manage applicable aging effects of the concrete basemat and Shield building cylinder wall and dome in the Containment Structure exposed to its environment. Loss of bond is not an applicable aging effect for these environments.
3.5.1-24	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (accessible areas): dome; wall; basemat	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801 with the following clarifications. The Structures Monitoring program will manage aging of cracking of Containment concrete elements exposed to Air-indoor, uncontrolled and Air-outdoor not within the scope of ASME Section XI, Subsection IWL. Increase in porosity and permeability and loss of material (spalling, scaling) due to aggressive chemical attack are not an applicable aging effect for these Component types in Air-indoor, uncontrolled and Air-outdoor. Loss of material is associated with aggressive chemical attack of containment structure concrete shield building cylinder wall and dome exposed to an Air-outdoor environment.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					See Item 3.5.1-21 for concrete elements within the scope of ASME Section XI, Subsection IWL. There are no concrete elements with aging effects of increase in porosity and permeability aligned with this item. For accessible and inaccessible concrete and porous concrete elements susceptible to an increase in porosity and permeability see items 3.5.1-13, 3.5.1-61 and 3.5.1-67.
3.5.1-25	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses; reinforcing steel	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"	No	Assigned to PWRs only
3.5.1-26	Moisture barriers (caulking, flashing, and other sealants)	Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects	Chapter XI.S1, "ASME Section XI, Subsection IWE"	No	The ISI (IWE) program is not used to manage moisture barriers. However, loss of sealing is a consequence of the aging effects cracking and change in material properties, and the Structures Monitoring Program manages the listed aging effect for similar elastomer commodities.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-27	penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, Suppression pool shell	Cracking due to cyclic loading (CLB fatigue analysis does not exist)	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, “10 CFR Part 50, Appendix J”	No	PNPP has a CLB fatigue analysis associated with penetration sleeves and suppression pool liner at the containment wall, and therefore this aging effect is addressed under line Item 3.5.1-9. PNPP is a BWR Mark III which does not have a torus, vent lines or downcomers.
3.5.1-28	Personnel airlock, equipment hatch, CRD hatch	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, “10 CFR Part 50, Appendix J”	No	Consistent with NUREG-1801. Loss of material for the personnel airlocks and equipment hatch will be managed by the ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J programs.
3.5.1-29	Personnel airlock, equipment hatch, CRD hatch: locks, hinges, and closure mechanisms	Loss of leak tightness due to mechanical wear of locks, hinges and closure mechanisms	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, “10 CFR Part 50, Appendix J”	No	Consistent with NUREG-1801. The Containment Inservice Inspection-IWE and Containment Leak Rate Programs manage the listed aging effect.
3.5.1-30	Pressure-retaining bolting	Loss of preload due to self-loosening	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	Consistent with NUREG-1801 for component and aging effect. Additionally, the Condensation environment is considered equivalent to Air - outdoor for evaluation of GALL consistency for Loss of preload for steel bolting.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-31	Pressure-retaining bolting, Steel elements: downcomer pipes	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, “ASME Section XI, Subsection IWE”	No	Consistent with NUREG-1801. Loss of material for pressure retaining structural bolting will be managed by the ASME Section XI, Subsection IWE program.
3.5.1-32	Prestressing system: tendons; anchorage components	Loss of material due to corrosion	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	NUREG- 1801 items referencing this item are associated with concrete containments and are applicable to PWR and BWR prestressed concrete containments. PNPP is a BWR with a free-standing SCV. There are no prestressed tendons associated with PNPP containment design.
3.5.1-33	Seals and gaskets	Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects	Chapter XI.S4, “10 CFR Part 50, Appendix J "	No	Consistent with NUREG-1801, with a different program assigned for some components and with the following clarifications. Aging of elastomer seals will be managed by the 10 CFR 50, Appendix J program. Aging effects for elastomer seals susceptible to change in material properties and cracking are aligned with the aging effect loss of sealing. The Structures Monitoring program will manage aging of elastomer upper containment pool gate seals which are not within the scope of the 10 CFR 50, Appendix J

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					program although located within the Containment Structure. Fire Protection Program will manage the loss of sealing in the Shield Building electrical penetration seals and sealants having a fire barrier (FB) intended function. Change in material properties and cracking is aligned with the aging effect loss of sealing. The External surfaces Monitoring of Mechanical Components will manage change in material properties and cracking of elastomer penetration sealant and door, manway, and hatch seals and gaskets exposed to Air-indoor, uncontrolled in Bulk Civil Commodities. Other elastomer seals and gaskets and fire penetration seals exposed to air are addressed under items 3.3.1-57 and 3.5.1-72.
3.5.1-34 (LR-ISG-2013-01)	Service Level I coatings	Loss of coating integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	Chapter XI.S8, "Protective Coating Monitoring and Maintenance"	No	Consistent with NUREG-1801. Loss of coating integrity of service level I coatings will be managed by the Protective Coating Monitoring and Maintenance program.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-35	Steel elements (accessible areas): liner; liner anchors; integral attachments, Penetration sleeves, Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket regions;, Steel elements (accessible areas): suppression chamber, drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable), Steel elements (accessible areas): drywell shell; drywell head	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J programs will manage loss of material of steel elements associated with the containment pressure boundary.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-36	Steel elements: drywell head; downcomers	Fretting or lockup due to mechanical wear	Chapter XI.S1, "ASME Section XI, Subsection IWE"	No	NUREG- 1801 items referencing this item are associated with Mark I and II BWR steel containment vessels. Perry's design is a BWR Mark III Steel containment, such that the PNPP design does not contain downcomers. The ASME Section XI, Subsection IWE program will be used to manage fretting or lockup of the carbon steel, steel elements: drywell head exposed to air - indoor uncontrolled in the Primary Containment.
3.5.1-37	Steel elements: suppression chamber (torus) liner (interior surface)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	NUREG- 1801 items referencing this item are associated with Mark I and II BWR concrete containments. Perry's steel containment is a BWR Mark III design and does not include a torus. Loss of material of the stainless steel clad containment vessel exposed to the suppression pool water will be managed by the ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J programs.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-38	Steel elements: suppression chamber shell (interior surface)	Cracking due to stress corrosion cracking	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	Three factors are necessary to initiate and propagate cracking due to stress corrosion cracking (SCC). These factors are susceptible or sensitized material (resulting from manufacturing or installation process), a high tensile stress (residual or applied), and corrosive environment (high temperatures, moist or wetted environment or an environment contaminated with chlorides, fluorides, or sulfates). Elimination or reduction of any of these factors will decrease the likelihood of SCC. SCC of PNPP stainless suppression chamber liner is not considered credible because the corrosive environment (concentration of chloride or sulfate contaminants and temperatures greater than 140°F) does not exist for the suppression chamber shell. Therefore, SCC of PNPP stainless suppression chamber liner is not expected.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-39	Steel elements: vent line bellows	Cracking due to stress corrosion cracking	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	NUREG- 1801 items referencing this item are associated with Mark I steel containments. Perry's design is a BWR Mark III Steel containment, such that the PNPP design does not contain components associated with vent line bellows.
3.5.1-40	Unbraced downcomers, Steel elements: vent header; downcomers	Cracking due to cyclic loading (CLB fatigue analysis does not exist)	Chapter XI.S1, "ASME Section XI, Subsection IWE"	No	NUREG- 1801 items referencing this item are associated with Mark II concrete and steel containments. Perry's design is a BWR Mark III Steel containment, such that the PNPP design does not contain components associated with unbraced downcomers and vent header; downcomers.
3.5.1-41	Steel elements: drywell support skirt, Steel elements (inaccessible areas): support skirt	None	None	NA - No AEM or AMP	NUREG- 1801 items referencing this item are associated with Mark I and II concrete and steel containments. Perry's design is a BWR Mark III Steel containment, such that the PNPP design does not contain components associated with a drywell support skirt.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-42	Groups 1-3, 5, 7-9:Concrete (inaccessible areas): foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)	Yes, for plants located in moderate to severe weathering conditions (See subsection 3.5.2.2.2.1.1)	Consistent with NUREG-1801. The loss of material (spalling, scaling) and cracking due to freeze thaw are not aging effects requiring management for PNPP Groups 1–3, 5, 7–9 structures. The absence of concrete aging effects is confirmed by the ASME Section XI, Subsection IWL and Structures Monitoring programs. For further evaluation, see Section 3.5.2.2.2.1 Item 1.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-43	All Groups except Group 6:Concrete (inaccessible areas): all	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated (See subsection 3.5.2.2.2.1.2)	Cracking due to expansion and reaction with aggregates for Groups 1– 5, 7–9 structures is not expected; however, this potential aging effect is managed, regardless of the mechanism that may cause the aging effect. Structures Monitoring program continues to inspect and monitor concrete structures for cracking due to any mechanism. Accessible concrete is monitored for cracking due to expansion from reaction with aggregates by the Structures Monitoring program that is addressed under Item Number 3.5-54. For further evaluation, see Section 3.5.2.2.2.1 item 2.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-44	All Groups: concrete: all	Cracking and distortion due to increased stress levels from settlement	Chapter XI.S6, "Structures Monitoring" If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.2.1.3)	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. PNPP has adequate settlement monitoring procedure in place. The program provides for periodic monitoring of settlement or rebound of safety class buildings by determining the elevation of permanent settlement markers. For further evaluation, see Section 3.5.2.2.2.1 Item 3.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-45	Groups 1-3, 5-9: concrete: foundation; subfoundation	Reduction in foundation strength, cracking due to differential settlement,erosion of porous concrete subfoundation	Chapter XI.S6, “Structures Monitoring” If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.2.1.3)	Consistent with NUREG-1801. PNPP does not rely on a dewatering system for control of settlement. The Structures Monitoring Program manages the listed aging effect. PNPP has adequate settlement monitoring procedure in place. The results of the monitoring program have demonstrated that cracks and distortion due to increased stress levels from settlement for below grade inaccessible concrete areas of structures for all groups and reduction in foundation strength, and cracking, due to differential settlement and erosion of porous concrete subfoundation in below grade inaccessible concrete areas for Groups 1–3, 5–9 structures is not an aging effect requiring management for PNPP concrete. For further evaluation, see Section 3.5.2.2.2.1 Item 3.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-46	Groups 1-3, 5-9: concrete: foundation; subfoundation	Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation	Chapter XI.S6, "Structures Monitoring" If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.2.1.3)	Consistent with NUREG-1801. PNPP does not rely on a dewatering system for control of settlement. The Structures Monitoring program conservatively manages loss of material, which would result in reduction of foundation strength and cracking due to differential settlement from erosion of porous concrete foundation, if it occurs. These aging effects are not expected to occur. The Structures Monitoring program will confirm it is not occurring. See Section 3.5.2.2.2.1 Item 3.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-47	Groups 1-5, 7-9: concrete (inaccessible areas): exterior above- and below-grade; foundation	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function (See subsection 3.5.2.2.2.1.4)	The PNPP below-grade environment is not aggressive. Therefore, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation of below grade inaccessible concrete areas are not aging effects requiring management for PNPP Groups 1–5 and 7–9 concrete structures. The absence of concrete aging effects is confirmed by the ASME Section XI, Subsection IWL and Structures Monitoring programs. For further evaluation, see Section 3.5.2.2.2.1 Item 4.
3.5.1-48	Groups 1-5: concrete: all	Reduction of strength and modulus due to elevated temperature (>150˚F general; >200˚F local)	A plant-specific aging management program is to be evaluated.	Yes, if temperature limits are exceeded (See subsection 3.5.2.2.2.2)	The reduction of strength and modulus of concrete due to elevated temperatures is not an aging effect requiring management for PNPP. For further evaluation, see Section 3.5.2.2.2.2.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-49	Groups 6 - concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)	Yes, for plants located in moderate to severe weathering conditions (See subsection 3.5.2.2.2.3.1)	The below grade inaccessible concrete areas of PNPP Group 6 structures were constructed in a manner that minimizes the potential for any freeze-thaw aging effects. Therefore, loss of material (spalling, scaling) and cracking due to freeze-thaw are not aging effects requiring management for PNPP Groups 6 structures. For further evaluation, see Section 3.5.2.2.2.3 Item 1.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-50	Groups 6: concrete (inaccessible areas): all	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated See subsection 3.5.2.2.2.3.2)	Consistent with NUREG-1801. Cracking due to expansion and reaction with aggregates in below grade inaccessible concrete areas of Group 6 Structures is not expected; however, this potential aging effect is managed regardless of the mechanism that caused the aging effect. Cracking associated with expansion due to reaction with aggregates has not been observed in PNPP Group 6 structures. Nevertheless, the Regulatory Guide (RG) 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program continues to inspect and monitor Group 6 concrete structures for cracking due to any mechanism. Accessible Group 6 concrete is monitored for cracking due to expansion from reaction with aggregates by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program and is addressed under Item Number 3.5.1-54. For further evaluation, see Section 3.5.2.2.2.3 Item 2.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-51	Groups 6: concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function (See subsection 3.5.2.2.2.3.3)	Consistent with NUREG-1801. Below-grade exterior reinforced concrete at PNPP is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate). Therefore, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible areas of concrete elements are not aging effects requiring management for below-grade inaccessible concrete areas of PNPP Group 6 structures. The absence of concrete aging effects is confirmed under the Structures Monitoring program. For further evaluation, see Section 3.5.2.2.2.3 Item 3.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-52	Groups 7, 8 - steel components: tank liner	Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific (See subsection 3.5.2.2.2.4)	Consistent with NUREG-1801. NUREG-1800 Section 3.5.2.2.2.4 applies to stainless steel liners for concrete or steel tanks. At PNPP, no tanks with stainless steel liners are included in the scope of license renewal. Pool and sump liners are normally below the threshold temperature for stress corrosion cracking. Loss of material for sump liners will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program as addressed in item 3.3.1-95. Loss of material for liners in treated water pools are managed by the Water Chemistry program as addressed in items 3.3.1-25 and 3.5.1-78. The One-Time Inspection program will confirm the effectiveness of the Water Chemistry program for pools in containment as addressed in item 3.3.1-25. For further evaluation, see Section 3.5.2.2.2.4.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-53	Support members; welds; bolted connections; support anchorage to building structure	Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists)	Yes, TLAA	Yes, TLAA (See subsection 3.5.2.2.2.5)	No CLB fatigue analysis exists for component supports members, welds, and support anchorage to building structure. For further evaluation, see Section 3.5.2.2.2.5.
3.5.1-54	All groups except 6: concrete (accessible areas): all	Cracking due to expansion from reaction with aggregates	Chapter XI.S6, “Structures Monitoring”	No	Consistent with NUREG-1801. The Structures Monitoring program will manage cracking of concrete in Containment.
3.5.1-55	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, “Structures Monitoring”	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-56	Concrete: exterior above- and below-grade; foundation; interior slab	Loss of material due to abrasion; cavitation	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effect.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-57	Constant and variable load spring hangers; guides; stops	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF program will manage aging of ASME Class 1, 2 and 3 supports.
3.5.1-58	Earthen water-control structures: dams; embankments; reservoirs; channels; canals and ponds	Loss of material; loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program will manage loss of material and loss of form for steel, galvanized steel, rock, stone and soil materials in intake and discharge structures, swales, streams (major, diversion and remnant minor, berms and culvert) comprising the Water Control Structures. Other aging effects for these component types are addressed in 3.5.1-59, 3.5.1-60 and 3.5.1-61.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-59	Group 6: concrete (accessible areas): all	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants program will manage aging of concrete components in water control structures. Loss of bond is inclusive with change in material properties. See also 3.5.1-58 for loss of material in concrete.
3.5.1-60	Group 6: concrete (accessible areas): exterior above- and below-grade; foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures associated with Nuclear Power Plants program will be used to manage loss of material (spalling, scaling) and cracking of the concrete due to freeze-thaw (accessible areas).

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-61	Group 6: concrete (accessible areas): exterior above- and below-grade; foundation; interior slab	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants program will manage change in material properties of concrete components exposed to raw water. Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation are inclusive of change in material properties. See also 3.5.1-13, 3.51-24 and 3.5.1-67 that address increase in porosity and permeability and 3.5.1-13 for loss of strength due to leaching of calcium hydroxide and carbonation for the other component types in structures and Bulk Civil Commodities.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-62	Group 6: Wooden Piles; sheeting	Loss of material; change in material properties due to weathering, chemical degradation, and insect infestation repeated wetting and drying, fungal decay	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	PNPP does not have the listed components associated with water control structures.
3.5.1-63	Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-64	Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S6, “Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring program will be used to manage loss of material (spalling, scaling) and cracking of the concrete due to freeze-thaw (accessible areas).

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-65	Groups 1-3, 5, 7-9: concrete (inaccessible areas): below-grade exterior; foundation, Groups 1-3, 5, 7-9: concrete (accessible areas): below-grade exterior; foundation, Groups 6: concrete (inaccessible areas): all	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring program will manage aging of concrete exposed to raw water and soil. Loss of bond is inclusive in change of material properties.
3.5.1-66	Groups 1-5, 7, 9: concrete (accessible areas): interior and above-grade exterior	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S6, “Structures Monitoring”	No	Consistent with NUREG-1801. The Structures Monitoring program will manage aging of concrete exposed to air - indoor, uncontrolled and air - outdoor. Loss of bond is inclusive in change of material properties.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-67	Groups 1-5, 7, 9: Concrete: interior; above-grade exterior, Groups 1-3, 5, 7-9 - concrete (inaccessible areas): below-grade exterior; foundation, Group 6: concrete (inaccessible areas): all	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring program will manage aging of concrete exposed to Air-outdoor, Raw water and Soil. Change in material properties is inclusive of increase in porosity and permeability for these component types. See also 3.5.1-13, 3.5.1-24 and 3.5.1-61 for where increase in porosity and permeability is addressed for the other structures and Bulk Civil Commodities subject to aging management review.
3.5.1-68	High-strength structural bolting	Cracking due to stress corrosion cracking	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF program will manage cracking of high strength structural bolting.
3.5.1-69	High-strength structural bolting	Cracking due to stress corrosion cracking	Chapter XI.S6, "Structures Monitoring“ Note: ASTM A 325, F 1852, and ASTM A 490 bolts used in civil structures have not shown to be prone to SCC. SCC potential need not be evaluated for these bolts.	No	Consistent with NUREG-1801. The Structures Monitoring program will manage cracking of high-strength structural bolting.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-70	Masonry walls: all	Cracking due to restraint shrinkage, creep, and aggressive environment	Chapter XI.S5, "Masonry Walls"	No	Consistent with NUREG-1801. The masonry walls that are within the scope of license renewal at PNPP are limited to isolated non-safety related, non-seismic Category I structures not meeting the criteria of I.E Bulletin 80-11. The Masonry Walls program manages aging of PNPP masonry block walls.
3.5.1-71	Masonry walls: all	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S5, "Masonry Walls"	No	Consistent with NUREG-1801. The masonry walls that are within the scope of license renewal at PNPP are limited to isolated non-safety related, non-seismic Category I structures not meeting the criteria of I.E Bulletin 80-11. The Masonry Walls program manages aging of PNPP masonry block walls.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-72	Seals; gasket; moisture barriers (caulking, flashing, and other sealants)	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801 with the following clarifications and a different program for some components. The Structures Monitoring program will manage aging of elastomer seals and barriers subject to aging management in the containment structure and bulk civil commodities exposed to air - indoor, uncontrolled, air - outdoor and treated water. Aging effects for elastomer seals susceptible to change in material properties and cracking are aligned with the aging effect loss of sealing. Fire Protection program will monitor the loss of sealing when acting as a fire barrier. Other elastomer seals and gaskets and fire penetration seals exposed to air are addressed under items 3.3.1-57 and 3.5.1-33.
3.5.1-73 (LR-ISG-2013-01)	Service Level I coatings	Loss of coating integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	Chapter XI.S8, "Protective Coating Monitoring and Maintenance"	No	Consistent with NUREG-1801. The Protective Coating Monitoring and Maintenance Program manage the listed aging effect.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-74	Sliding support bearings; sliding support surfaces	Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear	Chapter XI.S6, “Structures Monitoring”	No	Consistent with NUREG-1801. The Structures Monitoring program will be used to manage loss of mechanical distortion, dirt, debris, function of lubrite sliding support surfaces overload, wear exposed to air-indoor uncontrolled in Structures and Component Supports.
3.5.1-75	Sliding surfaces	Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF program will be used to manage loss of distortion, dirt, debris, mechanical function of lubrite sliding surfaces exposed to air-indoor uncontrolled in Structures and Component Supports.
3.5.1-76	Sliding surfaces: radial beam seats in BWR drywell	Loss of mechanical function due to corrosion, distortion, dirt, overload, wear	Chapter XI.S6, “Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring program will manage loss of mechanical function of sliding surfaces.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-77	Steel components: all structural steel	Loss of material due to corrosion	Chapter XI.S6, "Structures Monitoring" If protective coatings are relied upon to manage the effects of aging, the structures monitoring program is to include provisions to address protective coating monitoring and maintenance.	No	Consistent with NUREG-1801. The Structures Monitoring program will manage loss of material for for structural steel components exposed to Air-indoor, uncontrolled and Air-outdoor. Protective coatings are not relied upon to manage the effects of aging. Long term scaffolds are aligned to this item. Lifting lugs aging mechanism is aligned with this item. Also see Item 3.5.1-92.
3.5.1-78	Steel components: fuel pool liner	Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.	No, unless leakages have been detected through the SFP liner that cannot be accounted for from the leak chase channels	Consistent with NUREG-1801 for management of loss of material of the liner with some clarifications and program exceptions. The Water Chemistry program will manage loss of material for stainless steel fuel pool liner components. Spent fuel pool level is monitored in accordance with the Operational Requirements Manual. Leak chase channels are monitored periodically. For component types where leakage would not be relevant for detection of loss of material or cracking, the One-Time Inspection program will confirm the effectiveness of the Water Chemistry program. Loss of

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					material of stainless steel anchor bolts and embedments will be managed by the Structures Monitoring program. Cracking is not an aging effect for stainless steel exposed to treated water in the spent fuel pool, because normal temperature of the water is below the threshold for cracking of stainless steel (140F). See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.5.1-79	Steel components: piles	Loss of material due to corrosion	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801 with the following clarifications. PNPP does not have the steel piles. Structures Monitoring program will manage loss of material in steel component types exposed to raw water in Bulk Civil Commodities, Water Control Structures, and Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-80	Structural bolting	Loss of material due to general, pitting and crevice corrosion	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring program will manage loss of material for structural bolting. High strength steel is aligned with steel for loss of material. For high strength steel structural bolting exposed to Air-indoor subject to loss of material and within the scope of ASME Section XI, Subsection IWF, See Items 3.5.1-81. For other Anchor and Structural bolting in Air-outdoor subject to loss of material see Item 3.5.1-82.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-81	Structural bolting	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF program will manage loss of material for steel and high strength steel ASME Class 1, 2, 3 and MC Supports bolting exposed to Air-indoor, uncontrolled associated with ASME supports. High strength steel is aligned with steel for loss of material. For high strength steel structural bolting exposed to Air-indoor and Air-outdoor subject to loss of material and not within the scope of ASME Section XI, Subsection IWF, See Items 3.5.1-80 and 3.5.1-82. For steel ASME Class 1, 2, 3 and MC Supports bolting exposed to Air-outdoor see Item 3.5.1-86.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-82	Structural bolting	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring program will manage loss of material for structural bolting. High strength steel is aligned with steel for loss of material. For high strength steel structural bolting exposed to Air-indoor subject to loss of material and within the scope of ASME Section XI, Subsection IWF, See Items 3.5.1-81. For other Anchor and Structural bolting in Air-indoor, uncontrolled subject to loss of material see Item 3.5.1-80.
3.5.1-83	Structural bolting	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water- Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. In addition to managing structural bolting for water control structures, the Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program will manage aging of structural steel in water control structures.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-84	Structural bolting	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Consistent with NUREG-1801 with some program exceptions and with a different program credited. The Structures Monitoring and Water Chemistry programs will manage loss of material of the submerged drywell head and associated bolting. The bolting and head are removed during each refueling outage. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.5.1-85	Structural bolting	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water, and Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Consistent with NUREG-1 801 with some program exceptions. The ASME Section XI, Subsection IWF, and Water Chemistry programs will be used to manage loss of material of the stainless steel bolting and supports for ASME Class 2 and 3 piping and components exposed to the treated water environment. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-86	Structural bolting	Loss of material due to pitting and crevice corrosion	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF program will manage loss of material of structural bolting exposed to Air-outdoor associated with ASME supports. For structural bolting within the scope of ASME Section XI, Subsection IWF also see Item 3.5.1-81.
3.5.1-87	Structural bolting	Loss of preload due to self-loosening	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF program will manage loss of preload of structural bolting associated with ASME supports.
3.5.1-88	Structural bolting	Loss of preload due to self-loosening	Chapter XI.S6, “Structures Monitoring”	No	Consistent with NUREG-1801. The Structures Monitoring program will manage loss of preload for structural bolting.
3.5.1-89	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No	N/A - PWR Only

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-90	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water, and Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Consistent with NUREG-1801 with some program exceptions. Loss of material for stainless steel support members in treated water will be managed by the Water Chemistry and ASME Section XI, Subsection IWF programs. See Appendix B Section B.2.44 for Water Chemistry program exceptions to NUREG-1801.
3.5.1-91	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Consistent with NUREG-1801. The Inservice Inspection-IWF Program manage the listed aging effect.
3.5.1-92	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Structures Monitoring program will manage Loss of material of steel supports and anchorages and other steel commodities exposed to Air-indoor, uncontrolled and Air-outdoor. Also see Item 3.5.1-77.
3.5.1-93	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to pitting and crevice corrosion	Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Fire Protection program will manage loss of material for structural aluminum, stainless steel and galvanized steel components.

Table 3.5.1 Summary of Aging Management Evaluations for Containments, Structures and Component Supports					
Item Number	**Component**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-94	Vibration isolation elements	Reduction or loss of isolation function due to radiation hardening, temperature, humidity, sustained vibratory loading	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	PNPP does not have any vibration isolation elements. If any installed in future, Structures Monitoring Program will be used to manage the listed aging effects.
3.5.1-95	Aluminum, galvanized steel and stainless steel Support members; welds; bolted connections; support anchorage to building structure exposed to Air – indoor, uncontrolled	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.

Table 3.5.2-1
Containment Structure, Unit 1 (includes the reactor building and containment vessel)
Summary of Aging Management Evaluation

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Annulus and shield building cable supports	SNS, SSR, SRE	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
2	Beams, columns, floor slabs and interior walls	EN, FLB, MB, SRE, SSR, SHD	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
3	Beams, columns, floor slabs and interior walls (Containment (Drywell) Steam Tunnel)	MB, SNS, SPB, SSR, SHD, EN, SRE	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
4	Beams, columns, floor slabs and interior walls (Annulus Concrete)	SSR	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	ASME Section XI, Subsection IWL	II.B3.1.CP-74	3.5.1-21	A
5	Bolting	SPB, SSR	Stainless steel	Treated water (Ext)	Loss of material	Structures Monitoring and Water Chemistry	III.B1.3.TP-232	3.5.1-84	E

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
6	Bolting	SPB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWE	II.B4.CP-148	3.5.1-31	A
7	Bolting	SPB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Structures Monitoring	III.A4.TP-261	3.5.1-88	A
8	Containment auxiliary platform, equipment assembly and rails	SNS	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	C
9	Containment auxiliary platform, equipment assembly and rails	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A4.TP-302	3.5.1-77	A
10	Containment auxiliary platform, equipment assembly and rails1	SNS	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	C
11	Containment base slab	FLB, SNS, SPB, SRE, SSR	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B3.2.CP-89	3.5.1-23	A
12	Containment equipment hatch	EN, MB, SPB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.C-16	3.5.1-28	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
13	Containment equipment hatch	EN, MB, SPB, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.C-16	3.5.1-28	A
14	Containment equipment hatch crane girders and rails	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A4.TP-302	3.5.1-77	A
15	Containment foundation	SNS, SRE, SSR	Porous concrete	Raw water (Int)	Change in material properties	Structures Monitoring	II.B3.1.CP-53	3.5.1-13	A
16	Containment foundation	SNS, SRE, SSR	Porous concrete	Soil (Ext)	Change in material properties	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
17	Containment foundation	SNS, SRE, SSR	Porous concrete	Soil (Ext)	Loss of material	Structures Monitoring	III.A3.TP-31	3.5.1-46	A
18	Containment guard pipes	EN, MB, SPB, HELB	Steel	Air – indoor, uncontrolled (Int)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-36	3.5.1-35	A
19	Containment guard pipes	EN, MB, SPB, HELB	Steel	Concrete (Ext)	None	None	II.B1.2.CP-114	3.5.1-41	A
20	Containment monorails	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A4.TP-302	3.5.1-77	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
21	Containment penetration bellows and welds	SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	Cracking	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-38	3.5.1-10	A
22	Containment penetration bellows and welds	SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Int)	Cracking	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-38	3.5.1-10	A
23	Containment penetration bellows and welds	SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	Cracking	TLAA	II.B4.C-13	3.5.1-9	A
24	Containment penetration bellows and welds	SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Int)	Cracking	TLAA	II.B4.C-13	3.5.1-9	A
25	Containment personnel airlocks	EN, SPB, SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	C
26	Containment personnel airlocks	EN, SPB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.C-16	3.5.1-28	A
27	Containment personnel airlocks	SPB	Glass	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-9	3.4.1-55	C

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
28	Containment personnel airlocks	SPB	Glass	Air – indoor, uncontrolled (Int)	None	None	VIII.I.SP-9	3.4.1-55	C
29	Containment personnel airlocks seals	EN, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
30	Containment personnel airlocks seals	EN, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
31	Containment personnel airlocks seals	EN, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
32	Containment personnel airlocks seals	EN, SPB, SSR	Elastomer	Air-dry (Int)	Cracking	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
33	Containment personnel airlocks seals	EN, SPB, SSR	Elastomer	Air-dry (Int)	Loss of sealing	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
34	Containment personnel airlocks1	EN,SPB,SSR	Steel	Concrete (Ext)	None	None	II.B1.2.CP-114	3.5.1-41	A
35	Containment refueling platform and rails	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B.A-07	3.3.1-52	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
36	Containment sump structures	SSR	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
37	Containment sump structures1	SSR	Concrete	Raw water (Ext)	Change in material properties	Structures Monitoring	III.A2.TP-212	3.5.1-65	A
38	Containment sump structures1	SSR	Concrete	Raw water (Ext)	Cracking	Structures Monitoring	III.A2.TP-25	3.5.1-54	A
39	Containment sump structures1	SSR	Concrete	Raw water (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-27	3.5.1-65	A
40	Containment vessel	EN, MB, SNS, SPB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	II.B4.C-13	3.5.1-9	A
41	Containment vessel	EN, MB, SNS, SPB, SSR	Steel	Air – indoor, uncontrolled (Int)	Cumulative fatigue damage	TLAA	II.B4.C-13	3.5.1-9	A
42	Containment vessel	EN, MB, SNS, SPB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-36	3.5.1-35	A
43	Containment vessel	EN, MB, SNS, SPB, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-36	3.5.1-35	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
44	Containment vessel	EN, MB, SNS, SPB, SSR	Steel	Concrete (Int)	None	None	II.B2.2.CP-114	3.5.1-41	A
45	Containment vessel	EN, MB, SNS, SPB, SSR	Steel with stainless steel cladding	Air – indoor, uncontrolled (Int)	None	None	III.B3.TP-8	3.5.1-95	A
46	Containment vessel	EN, MB, SNS, SPB, SSR	Steel with stainless steel cladding	Treated water (Int)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B2.2.C-49	3.5.1-37	A
47	Containment vessel electrical penetrations	SNS, SPB, SRE, SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	Cracking	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-38	3.5.1-10	A
48	Containment vessel electrical penetrations	SNS, SPB, SRE, SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	Cracking	TLAA	II.B4.C-13	3.5.1-9	A
49	Containment vessel electrical penetrations	SNS, SPB, SRE, SSR	Stainless Steel	Gas (Int)	None	None	V.F.EP-22	3.2.1-63	A
50	Containment vessel electrical penetrations	SNS, SPB, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	II.B4.C-13	3.5.1-9	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
51	Containment vessel electrical penetrations	SNS, SPB, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-36	3.5.1-35	A
52	Containment vessel electrical penetrations	SNS, SPB, SRE, SSR	Steel	Gas (Int)	None	None	VII.J.AP-6	3.3.1-121	A
53	Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE	Stainless steel	Air – indoor, uncontrolled (Ext)	Cracking	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-38	3.5.1-10	A
54	Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE	Stainless steel	Air – indoor, uncontrolled (Int)	Cracking	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-38	3.5.1-10	A
55	Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE	Stainless steel	Air – indoor, uncontrolled (Ext)	Cracking	TLAA	II.B4.C-13	3.5.1-9	A
56	Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE	Stainless steel	Air – indoor, uncontrolled (Int)	Cracking	TLAA	II.B4.C-13	3.5.1-9	A
57	Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	II.B4.C-13	3.5.1-9	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
58	Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE	Steel	Air – indoor, uncontrolled (Int)	Cumulative fatigue damage	TLAA	II.B4.C-13	3.5.1-9	A
59	Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-36	3.5.1-35	A
60	Containment vessel mechanical penetrations	SPB, SSR, SNS, SRE	Steel	Air – indoor, uncontrolled (Int)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-36	3.5.1-35	A
61	Containment vessel1	EN, MB, SNS, SPB, SSR	Steel	Concrete (Ext)	None	None	II.B2.2.CP-114	3.5.1-41	A
62	Drywell	EN, FB, MB, SPB, SSR, DF, RP, PR, SRE	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Fire Protection	VII.G.A-90	3.3.1-60	A
63	Drywell	EN, FB, MB, SPB, SSR, DF, RP, PR, SRE	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
64	Drywell electrical penetrations	EN, SPB, SSR, FB, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.A-21	3.3.1-59	C
65	Drywell electrical penetrations	EN, SPB, SSR, FB, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
66	Drywell equipment hatch	EN, MB, SPB, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A
67	Drywell Equipment Hatch Seals	EN, MB, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
68	Drywell Equipment Hatch Seals	EN, MB, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
69	Drywell Equipment Hatch Seals	EN, MB, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
70	Drywell floor slab	EN, SSR, SNS, SRE	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
71	Drywell head	EN, MB, SPB, SSR	Stainless steel	Treated water (Ext)	Loss of material	Structures Monitoring and Water Chemistry	III.B1.3.TP-232	3.5.1-84	E
72	Drywell head	EN, MB, SPB, SSR	Stainless steel	Treated water (Int)	Loss of material	Structures Monitoring and Water Chemistry	III.B1.3.TP-232	3.5.1-84	E
73	Drywell head	EN, MB, SPB, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
74	Drywell head	EN, MB, SPB, SSR	Steel with stainless steel cladding	Treated water (Ext)	Loss of material	ASME Section XI, Subsection IWE and Structures Monitoring	III.B1.3.TP-232	3.5.1-84	E
75	Drywell liner plate	EN, MB, SPB, SSR	Steel with stainless steel cladding	Treated water (Int)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
76	Drywell liner plate	SPB, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A
77	Drywell liner plate	SPB, SSR	Steel	Concrete (Ext)	None	None	II.B2.2.CP-114	3.5.1-41	A
78	Drywell liner plate	SPB, SSR	Steel with stainless steel cladding	Air – indoor, uncontrolled (Int)	None	None	III.B3.TP-8	3.5.1-95	A
79	Drywell mechanical penetration (fiberglass fabric)	EN,SPB,SSR, FB, SRE	Unimpregnated fiberglass fabric; Fiberglass fabric impregnated with elastomer	Air – indoor, uncontrolled (Ext)	Change in Material Properties and Cracking	Fire Protection and Structures Monitoring	N/A	N/A	F, 517

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
80	Drywell mechanical penetration (fiberglass)	EN, SPB, SSR, FB, SRE	Fiberglass/ Alumina silicate/ Calcium silicate/ Mineral fiber	Air – indoor, uncontrolled (Ext)	None	None	N/A	N/A	J, 507
81	Drywell mechanical penetrations	EN, SPB, SSR, FB, SRE	Stainless steel	Air – indoor, uncontrolled (Ext)	Cracking	ASME Section XI, Subsection IWE and Structures Monitoring	II.B4.CP-38	3.5.1-10	E
82	Drywell mechanical penetrations	EN, SPB, SSR, FB, SRE	Stainless steel	Air – indoor, uncontrolled (Ext)	Cracking	Fire Protection	II.B3.2.C-24	3.5.1-38	E
83	Drywell mechanical penetrations	EN, SPB, SSR, FB, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
84	Drywell mechanical penetrations	EN, SPB, SSR, FB, SRE	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A, 516
85	Drywell mechanical penetrations	EN, SPB, SSR, FB, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A
86	Drywell mechanical penetrations	EN, SPB, SSR, FB, SRE	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A
87	Drywell mechanical penetrations1	EN,SPB,SSR, FB, SRE	Steel	Concrete (Ext)	None	None	II.B1.2.CP-114	3.5.1-41	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
88	Drywell personnel airlock	EN, SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
89	Drywell personnel airlock	EN, SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Int)	None	None	III.B2.TP-8	3.5.1-95	A
90	Drywell personnel airlock	EN, SPB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A
91	Drywell personnel airlock	EN, SPB, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A
92	Drywell personnel airlock (glass)	EN, SPB, SSR	Glass	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-9	3.4.1-55	C
93	Drywell personnel airlock (glass)	EN, SPB, SSR	Glass	Air – indoor, uncontrolled (Int)	None	None	VIII.I.SP-9	3.4.1-55	C
94	Drywell personnel airlock1	EN,SPB,SSR	Steel	Concrete (Ext)	None	None	II.B1.2.CP-114	3.5.1-41	A
95	Drywell wall vent structure	EN, MB, SPB, SSR	Steel with stainless steel cladding	Treated water (Ext)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
96	Drywell wall vent structure1	EN,MB,SPB, SSR	Steel with stainless steel cladding	Concrete (Int)	None	None	II.B2.2.CP-114	3.5.1-41	C

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
97	Drywell wall vents	SSR, PR, RP	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
98	Drywell wall vents1	SSR, PR, RP	Stainless steel	Concrete (Ext)	None	None	IV.E.RP-06	3.1.1-107	A
99	Drywell weir wall	EN, MB, SPB, SSR	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
100	Drywell weir wall	EN, MB, SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	C
101	Drywell weir wall	EN, SPB, SSR	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
102	Fuel Transfer tube penetration	SPB, SSR, FB	Steel	Air – indoor, uncontrolled (Int)	Cumulative fatigue damage	TLAA	II.B4.C-13	3.5.1-9	A
103	Fuel Transfer tube penetration	SPB, SSR, FB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-36	3.5.1-35	A
104	Fuel Transfer tube penetration	SPB, SSR, FB	Steel	Air – indoor, uncontrolled (Int)	Loss of material	ASME Section XI, Subsection IWE and 10 CFR 50, Appendix J	II.B4.CP-36	3.5.1-35	A
105	Fuel Transfer tube penetration	SPB, SSR, FB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
106	Fuel Transfer tube penetration	SPB, SSR, FB	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A, 516
107	Fuel Transfer tube penetration1	SPB,SSR, FB	Steel	Concrete (Ext)	None	None	II.B2.2.CP-114	3.5.1-41	A
108	Grounding bar	EN, SNS, SPB, SSR	Copper alloy <15% Zn	Concrete (Ext)	None	None	N/A	N/A	H, 513
109	Polar crane and rails	SSR	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	VII.B.A-06	3.3.1-1	A
110	Polar crane and rails	SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B.A-07	3.3.1-52	A
111	Quencher supports	SSR	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and ASME Section XI, Subsection IWF	III.B1.1.TP-10	3.5.1-90	B
112	Reactor pedestal	SSR	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
113	Reactor pedestal	SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
114	Reactor pedestal1	SSR	Steel	Concrete (Int)	None	None	II.B2.2.CP-114	3.5.1-41	A
115	Service level 1 coatings	SNS	Coatings	Air – indoor, uncontrolled (Ext)	Loss of coating integrity	Protective Coating Monitoring and Maintenance Program	II.B4.CP-152 (LR-ISG-2013-01)	3.5.1-34	A
116	Shield building cylinder wall and dome	EN, FB, FLB, MB, SNS, SPB, SRE, SSR, RP, SHD	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Fire Protection and Structures Monitoring	VII.G.A-90	3.3.1-60	A
117	Shield building cylinder wall and dome	EN, FLB, MB, SNS, SPB, SRE, SSR, RP, SHD	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
118	Shield building cylinder wall and dome	EN, FLB, MB, SNS, SPB, SRE, SSR, RP, SHD	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
119	Shield building cylinder wall and dome	EN, FLB, MB, SNS, SPB, SRE, SSR, RP, SHD	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
120	Shield building cylinder wall and dome	EN, FLB, MB, SNS, SPB, SRE, SSR, RP, SHD	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	II.B3.2.CP-89	3.5.1-23	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
121	Shield building cylinder wall and dome1	EN, FB, FLB, MB, SNS, SPB, SRE, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
122	Shield building cylinder wall and dome1	EN, FB, FLB, MB, SNS, SPB, SRE, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
123	Shield building cylinder wall and dome1	EN, FB, FLB, MB, SNS, SPB, SRE, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
124	Shield building electrical penetration seals and sealant	FB, SPB, SSR, FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
125	Shield building electrical penetration seals and sealant	FB, SPB, SSR, FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Fire Protection	II.B4.CP-41	3.5.1-33	E
126	Shield building electrical penetration seals and sealant	FB, SPB, SSR, FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
127	Shield building electrical penetration seals and sealant	FB, SPB, SSR, FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	Fire Protection	II.B4.CP-41	3.5.1-33	E
128	Shield building electrical penetration seals and sealant	FB, SPB, SSR, FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	10 CFR 50, Appendix J	II.B4.CP-41	3.5.1-33	A
129	Shield building electrical penetration seals and sealant	FB, SPB, SSR, FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Fire Protection	II.B4.CP-41	3.5.1-33	E
130	Structural steel	EN, MB, SNS, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A
131	Structural steel (w/SS cladding)	EN, MB, SNS, SSR	Steel with stainless steel cladding	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
132	Structural steel (w/SS cladding)1	EN,MB,SNS, SSR	Steel with stainless steel cladding	Treated water (Ext)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
133	Sump liners and penetrations	EN, SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	C

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
134	Sump liners and penetrations	EN, SPB, SSR	Stainless steel	Waste water (Ext)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
135	Sump liners and penetrations1	EN,SPB,SSR	Stainless steel	Concrete (Int)	None	None	IV.E.RP-06	3.1.1-107	C
136	Upper containment pool floor and walls	EN, MB, SNS, SSR	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
137	Upper containment pool floor and walls	EN, SNS, SPB, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	C
138	Upper containment pool floor and walls	EN, SNS, SPB, SSR	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
139	Upper containment pool floor and walls1	EN,MB,SNS, SSR	Stainless steel	Concrete (Int)	None	None	IV.E.RP-06	3.1.1-107	C
140	Upper containment pool gate steel	EN, SPB	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	III.A5.T-14	3.5.1-78	E

Table 3.5.2-1 - Containment Structure, Unit 1 (includes the reactor building and containment vessel)									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
141	Upper containment pool gates	EN, SPB	Aluminum	Treated water (Ext)	Cracking	Water Chemistry and One-Time Inspection	N/A	N/A	H, 528
142	Upper containment pool gates	EN, SPB	Aluminum	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-71	3.2.1-17	D
143	Upper containment pool gates seals	EN, SPB	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Structures Monitoring	II.B4.CP-41	3.5.1-33	E
144	Upper containment pool gates seals	EN, SPB	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B4.CP-41	3.5.1-33	E
145	Upper containment pool gates seals	EN, SPB	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	II.B4.CP-41	3.5.1-33	E
146	Upper containment pool gates seals1	EN,SPB	Elastomer	Treated water (Ext)	Cracking	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
147	Upper containment pool gates seals1	EN,SPB	Elastomer	Treated water (Ext)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
148	Upper containment pool gates1	EN,SPB	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	C

Table 3.5.2-2
Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures
Summary of Aging Management Evaluation

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Beams, columns, floor slabs and interior walls	EN, MB, SPB, SNS, SRE, SSR, FLB, SHD	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
2	Beams, columns, floor slabs and interior walls	FB	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Fire Protection and Structures Monitoring	VII.G.A-90	3.3.1-60	A
3	Control room ceiling support system	SNS	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
4	Control room ceiling support system	SNS	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
5	Control room ceiling support system	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
6	Crane rails	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
7	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
8	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Air – outdoor (Int)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
9	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
10	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Air – outdoor (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
11	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
12	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Air – outdoor (Int)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
13	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
14	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Air – outdoor (Int)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
15	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
16	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
17	CST dike and instrument missile shield	EN, MB, SNS, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
18	Diesel fuel tank maintenance structures	EN, MB, SNS, SRE, SSR	Concrete	Air – outdoor (Int)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
19	Diesel fuel tank maintenance structures	EN, MB, SNS, SRE, SSR	Concrete	Air – outdoor (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
20	Diesel fuel tank maintenance structures	EN, MB, SNS, SRE, SSR	Concrete	Air – outdoor (Int)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
21	Diesel fuel tank maintenance structures	EN, MB, SNS, SRE, SSR	Concrete	Air – outdoor (Int)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
22	Diesel fuel tank maintenance structures	EN, MB, SNS, SRE, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
23	Diesel fuel tank maintenance structures	EN, MB, SNS, SRE, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
24	Diesel fuel tank maintenance structures	EN, MB, SNS, SRE, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
25	Diesel fuel tank maintenance structures	EN, SNS, SRE	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-8	3.5.1-95	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
26	Diesel fuel tank maintenance structures	EN, SNS, SRE	Galvanized steel	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-300	3.5.1-69	A
27	Diesel fuel tank maintenance structures	EN, SNS, SRE	Galvanized steel	Soil (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
28	Diesel fuel tank maintenance structures1	EN, MB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
29	Diesel fuel tank maintenance structures1	EN, MB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
30	Diesel fuel tank maintenance structures1	EN, MB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
31	Diesel fuel tank maintenance structures1	EN, MB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
32	Diesel fuel unloading structure	SSR, FLB, MB	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
33	Diesel fuel unloading structure	SSR, FLB, MB	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
34	Diesel fuel unloading structure	SSR, FLB, MB	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
35	Diesel fuel unloading structure	SSR, FLB, MB	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
36	Diesel fuel unloading structure	SSR, FLB, MB	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
37	Diesel fuel unloading structure	SSR, FLB, MB	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
38	Diesel fuel unloading structure	SSR, FLB, MB	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
39	Duct banks	EN, SNS, SRE, SSR	Concrete	Air – outdoor (Int)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
40	Duct banks	EN, SNS, SRE, SSR	Concrete	Air – outdoor (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
41	Duct banks	EN, SNS, SRE, SSR	Concrete	Air – outdoor (Int)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
42	Duct banks	EN, SNS, SRE, SSR	Concrete	Air – outdoor (Int)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
43	Duct banks	EN, SNS, SRE, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
44	Duct banks	EN, SNS, SRE, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
45	Duct banks	EN, SNS, SRE, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
46	Exterior walls	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
47	Exterior walls	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
48	Exterior walls	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
49	Exterior walls	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
50	Exterior walls	EN, MB, SPB, SNS, SRE, SSR, FLB	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
51	Exterior walls (below grade)	EN, FLB, SPB, SNS, SRE, SSR	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
52	Exterior walls (below grade)	EN, FLB, SPB, SNS, SRE, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
53	Exterior walls (below grade)	EN, FLB, SPB, SNS, SRE, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
54	Exterior walls (below grade)	EN, FLB, SPB, SNS, SRE, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
55	Foundations	EN, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
56	Foundations	EN, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
57	Foundations	EN, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
58	Foundations	EN, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
59	Foundations	EN, SNS, SRE, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
60	Foundations	EN, SNS, SRE, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
61	Foundations	EN, SNS, SRE, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
62	Foundations	EN, SRE, SSR	Porous concrete	Raw water (Int)	Change in material properties	Structures Monitoring	II.B3.1.CP-53	3.5.1-13	A
63	Foundations	EN, SRE, SSR	Porous concrete	Soil (Ext)	Change in material properties	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
64	Foundations	EN, SRE, SSR	Porous concrete	Soil (Ext)	Loss of material	Structures Monitoring	III.A3.TP-31	3.5.1-46	A
65	Foundations caissons	EN, SRE, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
66	Foundations caissons	EN, SRE, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
67	Foundations caissons	EN, SRE, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
68	Fuel handling building crane	SSR, SNS	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	VII.B.A-06	3.3.1-1	A
69	Fuel handling building crane	SSR, SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B.A-07	3.3.1-52	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
70	Fuel handling building platform and rails	SSR, SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
71	Fuel pool liner plates and gates	EN, SPB, SSR	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
72	Fuel pool liner plates and gates (Aluminum)	EN,SPB,SSR	Aluminum	Treated water (Ext)	Cracking	Water Chemistry and One-Time Inspection	VII.E4.AP-130	3.3.1-24	D
73	Fuel pool liner plates and gates (Aluminum)	EN,SPB,SSR	Aluminum	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VII.E4.AP-130	3.3.1-24	D
74	Manholes	EN, SRE, SSR	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
75	Manholes	EN, SRE, SSR	Concrete	Air – outdoor (Int)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
76	Manholes	EN, SRE, SSR	Concrete	Air – outdoor (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
77	Manholes	EN, SRE, SSR	Concrete	Air – outdoor (Int)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
78	Manholes	EN, SRE, SSR	Concrete	Air – outdoor (Int)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
79	Manholes	EN, SRE, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
80	Manholes	EN, SRE, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
81	Manholes	EN, SRE, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
82	Manholes	EN, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
83	Manholes	EN, SRE, SSR	Steel	Air – outdoor (Int)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
84	Masonry walls	SNS, SRE	Concrete block	Air – indoor, uncontrolled (Int)	Cracking	Structures Monitoring	III.A1.T-12	3.5.1-70	E
85	Masonry walls	SNS, SRE	Concrete block	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A5.TP-34	3.5.1-71	E
86	Masonry walls	SNS, SRE	Concrete block	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A5.TP-34	3.5.1-71	E
87	Masonry walls	SNS, SRE	Concrete block	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A5.TP-34	3.5.1-71	E
88	Masonry walls	SNS, SRE	Concrete block	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A5.TP-34	3.5.1-71	E
89	Masonry Walls	SRE	Concrete block	Air – indoor, uncontrolled (Int)	Cracking	Structures Monitoring	III.A1.T-12	3.5.1-70	E

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
90	Masonry Walls	SRE	Concrete block	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A5.TP-34	3.5.1-71	E
91	Masonry Walls	SRE	Concrete block	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A5.TP-34	3.5.1-71	E
92	Masonry Walls	SRE	Concrete block	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A1.T-12	3.5.1-70	E
93	Masonry Walls	SRE	Concrete block	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A5.TP-34	3.5.1-71	E
94	Masts (Lighting)	SNS	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
95	Masts (Lighting)	SNS	Galvanized steel	Air – outdoor (Int)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
96	Metal siding	SNS, SRE, EN	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
97	Metal siding	SNS, SRE, EN	Aluminum	Air – outdoor (Ext)	Cracking	Structures Monitoring	V.E.E-406 (LR-ISG-2012-02)	3.2.1-71	E
98	Metal siding	SNS, SRE, EN	Aluminum	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
99	Metal siding	SNS, SRE, EN	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A
100	Metal siding	SNS, SRE, EN	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
101	Missile Protection	SNS,SRE	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
102	Missile Protection	SNS,SRE	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
103	Missile Protection	SNS,SRE	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
104	Missile Protection	SNS,SRE	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
105	Missile Protection Steel	SNS,SRE	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
106	Monorails	SNS, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
107	Pump well liners	EN, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
108	Pump well liners	EN, SSR	Steel	Concrete (Ext)	None	None	II.B2.1.CP-114	3.5.1-41	A
109	Pump well liners1	EN, SSR	Steel	Raw water (Int)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
110	Railroad bridge	FLB, SRE, SSR, SNS	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
111	Railroad bridge	FLB, SRE, SSR, SNS	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
112	Railroad bridge	FLB, SRE, SSR, SNS	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
113	Railroad bridge	FLB, SRE, SSR, SNS	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
114	Railroad bridge girder	FLB, SRE, SSR, SNS	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
115	Railroad bridge1	FLB, SRE, SSR, SNS	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A9.TP-29	3.5.1-67	A
116	Railroad bridge1	FLB, SRE, SSR, SNS	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A9.TP-212	3.5.1-65	A
117	Railroad bridge1	FLB, SRE, SSR, SNS	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A9.TP-212	3.5.1-65	A
118	Roof decking	FLB, SRE	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
119	Roof decking1	FLB,SRE	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
120	Roof hatches	EN, FLB, MB, SNS, SSR	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
121	Roof hatches	EN, FLB, MB, SNS, SSR	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
122	Roof hatches	EN, FLB, MB, SNS, SSR	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
123	Roof hatches	EN, FLB, MB, SNS, SSR	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
124	Roof hatches	EN, FLB, MB, SNS, SSR	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
125	Roof hatches	EN, FLB, MB, SNS, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
126	Roof hatches	EN, FLB, MB, SNS, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
127	Roof slabs	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
128	Roof slabs	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
129	Roof slabs	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
130	Roof slabs	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
131	Roof slabs	EN, FLB, MB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
132	Scupper cover (Roof)	SNS, SSR	Stainless steel	Air – outdoor (Ext)	Cracking	Structures Monitoring	N/A	N/A	H, 501

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
133	Scupper cover (Roof)	SNS, SSR	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
134	Scupper Covers (Fuel Pool)	SNS,SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	C
135	Scupper Covers1 (Fuel Pool)	SNS,SSR	Stainless Steel	Treated water (Ext)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
136	Scuppers (Fuel pool)	SNS, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	C
137	Scuppers (Fuel pool)	SNS, SSR	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
138	Scuppers (Roof)	SNS, SSR	Stainless steel	Air – outdoor (Ext)	Cracking	Structures Monitoring	N/A	N/A	H, 501
139	Scuppers (Roof)	SNS, SSR	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
140	Service water valve pit	SSR	Concrete	Air – outdoor (Int)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
141	Service water valve pit	SSR	Concrete	Air – outdoor (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
142	Service water valve pit	SSR	Concrete	Air – outdoor (Int)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
143	Service water valve pit	SSR	Concrete	Air – outdoor (Int)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
144	Service water valve pit	SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
145	Service water valve pit	SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
146	Service water valve pit	SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
147	Structural steel: beams, columns, plates	EN, MB, SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
148	Sump liners	SNS, SRE, SSR	Stainless steel	Concrete (Ext)	None	None	IV.E.RP-06	3.1.1-107	C
149	Sump liners	SNS, SRE, SSR	Stainless steel	Waste water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
150	Sump liners1	SNS, SRE, SSR	Stainless Steel	Air – indoor, uncontrolled (Int)	None	None	III.B1.1.TP-8	3.5.1-95	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
151	Sumps	SNS, SRE, SSR	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
152	Sumps	SNS, SRE, SSR	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
153	Sumps	SNS, SRE, SSR	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
154	Sumps	SNS, SRE, SSR	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
155	Sumps1	SNS, SRE, SSR	Concrete	Raw water (Int)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
156	Sumps1	SNS, SRE, SSR	Concrete	Raw water (Int)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
157	Sumps1	SNS, SRE, SSR	Concrete	Raw water (Int)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
158	Thrust blocks	SRE, SNS	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
159	Thrust blocks	SRE, SNS	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
160	Thrust blocks	SRE, SNS	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A

Table 3.5.2-2 - Turbine Buildings and Associated Structures, Process Facilities, and Yard Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
161	Transmission towers	SRE	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
162	Valve support slabs, buried	SRE	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
163	Valve support slabs, buried	SRE	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
164	Valve support slabs, buried	SRE	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
165	Windows	FLB	Aluminum	Air – indoor, uncontrolled (Int)	None	None	III.B5.TP-8	3.5.1-95	A
166	Windows	FLB	Aluminum	Air – outdoor (Ext)	Cracking	Structures Monitoring	V.E.E-406 (LR-ISG-2012-02)	3.2.1-71	E
167	Windows	FLB	Aluminum	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
168	Windows	FLB	Glass	Air – indoor, uncontrolled (Int)	None	None	VIII.I.SP-9	3.4.1-55	C
169	Windows	FLB	Glass	Air – outdoor (Ext)	None	None	VIII.I.SP-108	3.4.1-55	C

**Table 3.5.2-3
Water Control Structures
Summary of Aging Management Evaluation**

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Beams and columns	EN, HS, SNS, SSR, SRE	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
2	Beams and columns	EN, HS, SNS, SSR, SRE	Concrete	Raw water (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-37	3.5.1-61	A
3	Beams and columns	EN, HS, SNS, SSR, SRE	Concrete	Raw water (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
4	Beams and columns	EN, HS, SNS, SSR, SRE	Concrete	Raw water (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-3 - Water Control Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
5	Caissons, ice protection	SSR	Concrete	Raw water (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-37	3.5.1-61	A
6	Caissons, ice protection	SSR	Concrete	Raw water (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
7	Caissons, ice protection	SSR	Concrete	Raw water (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
8	Caissons, ice protection	SSR	Steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
9	Culvert, major stream	SNS,FLB	Galvanized steel	Raw water (Int)	Cracking	Structures Monitoring	III.A3.TP-300	3.5.1-69	A
10	Culvert, major stream	SNS,FLB	Galvanized steel	Raw water (Int)	Flow Blockage	Structures Monitoring	N/A	N/A	H, 530

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
11	Culvert, major stream	SNS,FLB	Galvanized steel	Raw water (Int)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
12	Culvert, major stream	SNS,FLB	Galvanized steel	Soil (Ext)	Cracking	Structures Monitoring	III.A3.TP-300	3.5.1-69	A
13	Culvert, major stream	SNS,FLB	Galvanized steel	Soil (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
14	Culvert, major stream	SNS,FLB	Rock/Stone /Soil	Raw water (Int)	Loss of form	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
15	Diversion Stream	FLB, SNS	Rock/Stone /Soil	Raw water (Ext)	Loss of form	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A

Table 3.5.2-3 - Water Control Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
16	Diversion Stream Berm	FLB, SNS	Rock/Stone /Soil	Raw water (Ext)	Loss of form	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
17	ESW Pumphouse Crane	SNS	Steel	Air – indoor, uncontrolled (Ext)	Cumulative fatigue damage	TLAA	VII.B.A-06	3.3.1-1	A
18	ESW Pumphouse Crane	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B.A-07	3.3.1-52	A
19	Exterior walls above grade	EN, HS, MB, SNS, SSR,SRE,FLB	Concrete	Air – indoor, uncontrolled (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
20	Exterior walls above grade	EN, HS, MB, SNS, SSR,SRE,FLB	Concrete	Air – outdoor (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-3 - Water Control Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
21	Exterior walls above grade	EN, HS, MB, SNS, SSR,SRE,FL B	Concrete	Air – outdoor (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
22	Exterior walls above grade	EN, HS, MB, SNS, SSR,SRE,FL B	Concrete	Air – outdoor (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
23	Exterior walls above grade	EN, HS, MB, SNS, SSR,SRE,FL B	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
24	Exterior walls above grade	EN, HS, SNS, SSR,SRE,FL B	Elastomer	Air – indoor, uncontrolled (Int)	Change in material properties and cracking	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
25	Exterior walls above grade	EN, HS, SNS, SSR,SRE,FL B	Elastomer	Air – indoor, uncontrolled (Int)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A

Table 3.5.2-3 - Water Control Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
26	Exterior walls above grade	EN, HS, SNS, SSR,SRE,FLB	Elastomer	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
27	Exterior walls above grade	EN, HS, SNS, SSR,SRE,FLB	Galvanized steel	Air – indoor, uncontrolled (Int)	None	None	III.B4.TP-8	3.5.1-95	A
28	Exterior walls above grade	EN, HS, SNS, SSR,SRE,FLB	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
29	Exterior walls above grade	EN, HS, SNS, SSR,SRE,FLB	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
30	Exterior walls below grade	EN, HS, SNS, SSR,SRE	Concrete	Air – indoor, uncontrolled (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
31	Exterior walls below grade	EN, HS, SNS, SSR,SRE	Concrete	Raw water (Int)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-37	3.5.1-61	A

Table 3.5.2-3 - Water Control Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
32	Exterior walls below grade	EN, HS, SNS, SSR,SRE	Concrete	Raw water (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
33	Exterior walls below grade	EN, HS, SNS, SSR,SRE	Concrete	Raw water (Int)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
34	Exterior walls below grade	EN, HS, SNS, SSR,SRE	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A6.TP-107	3.5.1-67	A
35	Exterior walls below grade	EN, HS, SNS, SSR,SRE	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
36	Exterior walls below grade	EN, HS, SNS, SSR,SRE	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
37	Floor slab	EN, HS, SNS, SSR,SRE	Concrete	Air – indoor, uncontrolled (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
38	Floor slab	EN, HS, SNS, SSR,SRE	Concrete	Raw water (Int)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-37	3.5.1-61	A
39	Floor slab	EN, HS, SNS, SSR,SRE	Concrete	Raw water (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
40	Floor slab	EN, HS, SNS, SSR,SRE	Concrete	Raw water (Int)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
41	Foundation	EN, HS, SNS, SSR	Porous concrete	Raw water (Int)	Change in material properties	Structures Monitoring	II.B3.1.CP-53	3.5.1-13	A
42	Foundation	EN, HS, SNS, SSR	Porous concrete	Raw water (Int)	Loss of Material	Structures Monitoring	III.A3.TP-31	3.5.1-46	A
43	Foundation	EN, HS, SNS, SSR	Porous concrete	Soil (Ext)	Change in material properties	Structures Monitoring	II.B3.2.CP-84	3.5.1-24	A
44	Foundation	EN, HS, SNS, SSR	Porous concrete	Soil (Ext)	Loss of material	Structures Monitoring	III.A3.TP-31	3.5.1-46	A

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
45	Intake/discharge structures	HS, SSR, SRE	Steel	Raw water (Int)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
46	Intake/discharge structures	HS, SSR,SRE	Concrete	Raw water (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-37	3.5.1-61	A
47	Intake/discharge structures	HS, SSR,SRE	Concrete	Raw water (Int)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-37	3.5.1-61	A
48	Intake/discharge structures	HS, SSR,SRE	Concrete	Raw water (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-3 - Water Control Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
49	Intake/discha rge structures	HS, SSR,SRE	Concrete	Raw water (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
50	Intake/discha rge structures	HS, SSR,SRE	Concrete	Raw water (Int)	Flow Blockage	Structures Monitoring	N/A	N/A	H, 529
51	Intake/discha rge structures	HS, SSR,SRE	Concrete	Raw water (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
52	Intake/discha rge structures	HS, SSR,SRE	Concrete	Raw water (Int)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
53	Intake/discha rge structures (Steel)	HS,SSR,SRE	Steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
54	Intake/discha rge tunnel	HS, SSR, SRE	Concrete	Raw water (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
55	Intake/discha rge tunnel	HS, SSR, SRE	Concrete	Raw water (Int)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
56	Intake/discha rge tunnel	HS, SSR, SRE	Concrete	Raw water (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
57	Intake/discha rge tunnel	HS, SSR, SRE	Concrete	Raw water (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
58	Intake/discha rge tunnel	HS, SSR, SRE	Concrete	Raw water (Int)	Flow Blockage	Structures Monitoring	N/A	N/A	H, 529

Table 3.5.2-3 - Water Control Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
59	Intake/discharge tunnel	HS, SSR, SRE	Concrete	Raw water (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
60	Intake/discharge tunnel	HS, SSR, SRE	Concrete	Raw water (Int)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
61	Intake/discharge tunnel	HS, SSR, SRE	Steel	Raw water (Int)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
62	Interior walls	EN, HS, MB, SNS, SSR, SRE	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
63	Interior walls	EN, HS, MB, SNS, SSR, SRE	Concrete	Raw water (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-37	3.5.1-61	A

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
64	Interior walls	EN, HS, MB, SNS, SSR, SRE	Concrete	Raw water (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
65	Interior walls	EN, HS, MB, SNS, SSR, SRE	Concrete	Raw water (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
66	Interior walls	FB, SRE	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Fire Protection and Structures Monitoring	VII.G.A-90	3.3.1-60	A
67	Major and minor stream beds	SNS	Rock/Stone /Soil	Raw water (Ext)	Loss of form	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
68	Major and minor stream beds	SNS	Rock/Stone /Soil	Raw water (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
69	Major Stream	FLB, SNS	Rock/Stone /Soil	Raw water (Ext)	Loss of form	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
70	Major Stream	FLB, SNS	Rock/Stone /Soil	Raw water (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
71	Remnant Minor Stream	FLB, SNS	Rock/Stone /Soil	Raw water (Ext)	Loss of form	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
72	Remnant Minor Stream	FLB, SNS	Rock/Stone /Soil	Raw water (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
73	Roof Drains	FLB	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
74	Roof Drains	FLB	Steel	Raw water (Int)	Flow Blockage	Structures Monitoring	N/A	N/A	H, 530
75	Roof Drains	FLB	Steel	Raw water (Int)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
76	Roof hatches	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – indoor, uncontrolled (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
77	Roof hatches	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – outdoor (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
78	Roof hatches	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – outdoor (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
79	Roof hatches	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – outdoor (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
80	Roof hatches	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
81	Roof Slab and Ceiling of DDFP Room	EN, FB, MB, SNS, SRE, FLB, EN,FB.MB,SNS,SSR	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Fire Protection and Structures Monitoring	VII.G.A-90	3.3.1-60	A
82	Roof slabs	EN, MB, SNS, SSR, FLB, SRE	Concrete	Air – indoor, uncontrolled (Int)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
83	Roof slabs	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – outdoor (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
84	Roof slabs	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – outdoor (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
85	Roof slabs	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – outdoor (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
86	Roof slabs	EN, MB, SNS, SSR,FLB, SRE	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
87	Roof slabs	FB, SRE	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Fire Protection and Structures Monitoring	VII.G.A-90	3.3.1-60	A
88	Structural steel, beams, columns and plates	EN, HS, SNS, SSR,SRE	Steel	Raw water (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A

Table 3.5.2-3 - Water Control Structures

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
89	Structural steel, beams, columns and plates (including sluice gate frames)	EN,HS, SNS, SSR,SRE	Steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
90	Structural steel, beams, columns and plates (including sluice gate frames)1	EN,HS,SNS, SSR,SRE	Steel	Air – indoor, uncontrolled (Int)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-221	3.5.1-83	A
91	Swale	SNS, FLB	Rock/Stone /Soil	Raw water (Ext)	Loss of form	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A
92	Swale	SNS, FLB	Rock/Stone /Soil	Raw water (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A

Table 3.5.2-3 - Water Control Structures									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
93	Swale1	SNS,FLB	Rock/Stone /Soil	Air – outdoor (Ext)	Loss of form	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.T-22	3.5.1-58	A

Table 3.5.2-4
Bulk Commodities
Summary of Aging Management Evaluation

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Abandoned piping for System E32 at various penetrations	SPB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
2	Aircraft Cables	SNS	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
3	Anchor bolts	SNS	Stainless steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Structures Monitoring	III.A3.TP-261	3.5.1-88	A
4	Anchor bolts	SNS, SRE	Stainless steel	Air – outdoor (Ext)	Cracking	Structures Monitoring	II.B4.CP-37	3.5.1-27	E
5	Anchor bolts	SNS, SRE	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
6	Anchor bolts	SNS, SRE	Stainless steel	Air – outdoor (Ext)	Loss of preload	Structures Monitoring	III.A3.TP-261	3.5.1-88	A
7	Anchor bolts	SNS, SRE, SSR	High strength steel	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-300	3.5.1-69	A
8	Anchor bolts	SNS, SRE, SSR	High strength steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-248	3.5.1-80	A
9	Anchor bolts	SNS, SRE, SSR	High strength steel	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-300	3.5.1-69	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
10	Anchor bolts	SNS, SRE, SSR	High strength steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-274	3.5.1-82	A
11	Anchor bolts	SNS, SRE, SSR	Stainless steel	Treated water (Ext)	Loss of material	Structures Monitoring	III.A5.T-14	3.5.1-78	E
12	Anchor bolts	SNS, SRE, SSR	Stainless steel	Treated water (Ext)	Loss of preload	Structures Monitoring	III.A5.TP-261	3.5.1-88	A
13	Anchor bolts	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-248	3.5.1-80	A
14	Anchor bolts	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Structures Monitoring	III.B2.TP-261	3.5.1-88	A
15	Anchor bolts	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-274	3.5.1-82	A
16	Anchor bolts	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of preload	Structures Monitoring	III.B2.TP-261	3.5.1-88	A
17	Anchorage/embe dments	SNS, SRE, SSR	Stainless Steel	Treated water (Ext)	Loss of material	Structures Monitoring	III.A5.T-14	3.5.1-78	E
18	Anchorage/embe dments	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
19	Anchorage/embe dments	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
20	Anchorage/embe dments	SNS, SRE, SSR	Steel	Raw water (Ext)	Cracking	Structures Monitoring	N/A	N/A	H, 519
21	Anchorage/embe dments	SNS, SRE, SSR	Steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
22	Anchorage/embedments (GS)	SNS, SRE, SSR	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B1-3.TP-8	3.5.1-95	A
23	Anchorage/embedments (GS1)	SNS, SRE, SSR	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A5.TP-274	3.5.1-82	A
24	ASME Class 1, 2, 3 and MC Supports bolting	SNS, SRE, SSR	High strength steel	Air – indoor, uncontrolled (Ext)	Cracking	ASME Section XI, Subsection IWF	III.B1.1.TP-41	3.5.1-68	A
25	ASME Class 1, 2, 3 and MC Supports bolting	SNS, SRE, SSR	High strength steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWF	III.B1.1.TP-226	3.5.1-81	A
26	ASME Class 1, 2, 3 and MC Supports bolting	SNS, SRE, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	Loss of preload	ASME Section XI, Subsection IWF	III.B1.1.TP-229	3.5.1-87	A
27	ASME Class 1, 2, 3 and MC Supports bolting	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWF	III.B1.1.TP-226	3.5.1-81	A
28	ASME Class 1, 2, 3 and MC Supports bolting	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	ASME Section XI, Subsection IWF	III.B1.1.TP-229	3.5.1-87	A
29	ASME Class 1, 2, 3 and MC Supports bolting	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	ASME Section XI, Subsection IWF	III.B1.1.TP-235	3.5.1-86	A
30	ASME Class 1, 2, 3 and MC Supports bolting	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of preload	ASME Section XI, Subsection IWF	III.B1.1.TP-229	3.5.1-87	A
31	Base plates	SNS, SRE, SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
32	Base plates	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
33	Base plates	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
34	Base Plates1	SNS, SRE, SSR	Stainless Steel	Concrete (Ext)	None	None	VII.J.AP-19	3.3.1-120	C
35	Base Plates2	SNS, SRE, SSR	Steel	Concrete (Ext)	None	None	II.B2.1.CP-114	3.5.1-41	A
36	Battery racks	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
37	Bird screens	SNS, SRE	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
38	Cable trays	SNS, SRE, SSR	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
39	Cable trays	SNS, SRE, SSR	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
40	Cable trays	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
41	Cable trays support	SNS, SRE, SSR	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
42	Cable trays support	SNS, SRE, SSR	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
43	Cable trays support	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
44	Cable trays support	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
45	Cask Pit Pool Waste Storage Rack	SHD,SNS	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B1.2.TP-8	3.5.1-95	A
46	Cask Pit Pool Waste Storage Rack1	SHD,SNS	Stainless Steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	III.A5.T-14	3.5.1-78	E
47	Catch Basin Steel Covers	FLB,SNS	Steel	Raw water (Int)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
48	Catch Basin Steel Covers	FLB,SNS	Steel	Soil (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
49	Catch Basin Steel Covers1	FLB,SNS	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
50	Catch Basins and Catch Basin Covers	FLB,SNS	Concrete	Raw water (Int)	Change in material properties	Structures Monitoring	III.A6.TP-107	3.5.1-67	A
51	Catch Basins and Catch Basin Covers	FLB,SNS	Concrete	Raw water (Int)	Cracking	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
52	Catch Basins and Catch Basin Covers	FLB,SNS	Concrete	Raw water (Int)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A6.TP-104	3.5.1-65	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
53	Catch Basins and Catch Basin Covers	FLB,SNS	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A6.TP-107	3.5.1-67	A
54	Catch Basins and Catch Basin Covers	FLB,SNS	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
55	Catch Basins and Catch Basin Covers	FLB,SNS	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
56	Component and piping supports	SNS, SRE, SSR	Aluminum	Treated water (Ext)	Cracking	Water Chemistry and One-Time Inspection	VII.G.A-412	3.3.1-136 (LR-ISG-2012-02)	E
57	Component and piping supports	SNS, SRE, SSR	Aluminum	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	V.D2.EP-71	3.2.1-17	C
58	Component and piping supports	SNS, SRE, SSR	Galvanized Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
59	Component and piping supports	SNS, SRE, SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
60	Component and piping supports	SNS, SRE, SSR	Stainless steel	Air – outdoor (Ext)	Cracking	Structures Monitoring	II.B4.CP-37	3.5.1-27	E
61	Component and piping supports	SNS, SRE, SSR	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
62	Component and piping supports	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	ASME Section XI, Subsection IWF	III.B1.1.T-24	3.5.1-91	A
63	Component and piping supports	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
64	Component and piping supports	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	ASME Section XI, Subsection IWF	III.B1.1.T-24	3.5.1-91	A
65	Component and piping supports	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
66	Component and piping supports	SNS, SRE, SSR	Steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
67	Component and piping supports1	SNS, SRE, SSR	Galvanized steel	Air – outdoor (Ext)	Loss of material	ASME Section XI, Subsection IWF	III.B2.TP-6	3.5.1-93	E
68	Component and piping supports2	SNs, SRE, SSR	Stainless Steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	B
69	Components and Piping Supports 3	SNS, SRE, SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
70	Concrete Fire Barrier	FB	Concrete	Air – outdoor (Ext)	Change in material properties	Fire Protection and Structures Monitoring	VII.G.A-92	3.3.1-61	A
71	Concrete Fire Barrier	FB	Concrete	Air – outdoor (Ext)	Cracking	Fire Protection and Structures Monitoring	VII.G.A-92	3.3.1-61	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
72	Concrete Fire Barrier	FB	Concrete	Air – outdoor (Ext)	Loss of material	Fire Protection and Structures Monitoring	VII.G.A-93	3.3.1-62	A
73	Concrete Fire Barrier	FB	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Fire Protection and Structures Monitoring	VII.G.A-93	3.3.1-62	A
74	Conduit caps	FLB	Polymer	Air – indoor, uncontrolled (Ext)	Loss of strength	Structures Monitoring	N/A	N/A	H, 518
75	Conduit supports	SNS, SRE, SSR	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
76	Conduit supports	SNS, SRE, SSR	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
77	Conduit supports	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
78	Conduit supports	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
79	Conduits	SNS, SRE, SSR	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
80	Conduits	SNS, SRE, SSR	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
81	Conduits	SRE	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
82	Conduits	SRE	Aluminum	Air – outdoor (Ext)	Cracking	Structures Monitoring	V.E.E-406 (LR-ISG-2012-02)	3.2.1-71	E
83	Conduits	SRE	Aluminum	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
84	Conduits	SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	C
85	Conduits	SSR	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
86	Conduits1	SNS,SRE,SSR	Galvanized steel	Concrete (Ext)	None	None	II.B2.1.CP-114	3.5.1-41	C, 521
87	Conduits2	SNS,SRE,SSR	Galvanized Steel	Soil (Ext)	Cracking	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
88	Conduits2	SNS,SRE,SSR	Galvanized Steel	Soil (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
89	Conduits3	SNS, SRE, SSR	Stainless Steel	Concrete (Ext)	None	None	IV.E.RP-06	3.1.1-107	A
90	Conduits4	SNS, SRE, SSR	Stainless Steel	Soil (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
91	Containment Isolation Dampers for U2 Containment Isolation (2M14)	FB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
92	Containment Isolation Dampers for U2 Containment Isolation (2M14)	FB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
93	Cranes Trollies Monorail Hoists	SNS,SRE,SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
94	Damper and louver housings and fixed louvers	SNS, SRE, SSR, FB	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	C
95	Damper and louver housings and fixed louvers1	SNS, SRE, SSR, FB	Aluminum	Air – outdoor (Ext)	Cracking	Fire Protection	VII.I.A-405 (LR-ISG-2012-02)	3.3.1-132	E
96	Damper and louver housings and fixed louvers1	SNS, SRE, SSR, FB	Aluminum	Air – outdoor (Ext)	Cracking	Structures Monitoring	V.E.E-406 (LR-ISG-2012-02)	3.2.1-71	E
97	Damper and louver housings and fixed louvers1	SNS, SRE, SSR, FB	Aluminum	Air – outdoor (Ext)	Loss of material	Fire Protection	VII.I.A-405 (LR-ISG-2012-02)	3.3.1-132	E
98	Damper and louver housings and fixed louvers1	SNS, SRE, SSR, FB	Aluminum	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	C
99	Damper and louver housings and fixed louvers2	SNS, SRE, SSR, FB	Steel	Air – outdoor (Ext)	Loss of material	Fire Protection	VII.G.A-22	3.3.1-59	C
100	Damper and louver housings and fixed louvers2	SNS, SRE, SSR, FB	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
101	Damper and louver housings and fixed louvers3	SNS, SRE, SSR, FB	Galvanized Steel	Air – outdoor (Ext)	Loss of material	Fire Protection	III.B2.TP-6	3.5.1-93	E
102	Damper and louver housings and fixed louvers3	SNS, SRE, SSR, FB	Galvanized Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
103	Damper and louver housings and fixed louvers4	SNS, SRE, SSR, FB	Galvanized Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	C
104	Diesel Exhaust hallway Insulation bolting	EN,SSR,SNS	Stainless Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
105	Diesel Exhaust hallway Insulation bolting1	EN,SSR,SNS	Stainless Steel	Diesel exhaust (Ext)	Cracking	Structures Monitoring	VII.H2.AP-128	3.3.1-83	E
106	Diesel Exhaust hallway Insulation bolting1	EN,SSR,SNS	Stainless Steel	Diesel exhaust (Ext)	Loss of material	Structures Monitoring	VII.H2.AP-104	3.3.1-88	E
107	Electrical and instrument panels and enclosures	SNS, SRE, SSR	Galvanized steel	Air – indoor, uncontrolled (Int)	None	None	III.B2.TP-8	3.5.1-95	A
108	Electrical and instrument panels and enclosures	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
109	Electrical and instrument panels and enclosures	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
110	Electrical and instrument panels and enclosures	SRE	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
111	Equipment pads/foundations	SNS, SRE, SSR, FLB	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
112	Equipment pads/foundations	SNS, SRE, SSR, FLB	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
113	Equipment pads/foundations	SNS, SRE, SSR, FLB	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
114	Equipment pads/foundations	SNS, SRE, SSR, FLB	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
115	Equipment pads/foundations	SNS, SRE, SSR, FLB	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
116	Equipment pads/foundations 1	SNS, SRE, SSR, FLB	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A6.TP-107	3.5.1-67	A
117	Equipment pads/foundations 1	SNS, SRE, SSR, FLB	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A6.TP-107	3.5.1-67	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
118	Equipment pads/foundations 1	SNS, SRE, SSR, FLB	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
119	Expansion joint	FLB, SSR, EN, EXP	Elastomer	Air – outdoor (Ext)	Cracking	Structures Monitoring	II.B4.CP-41	3.5.1-33	E
120	Expansion joint	FLB, SSR, EN, EXP	Galvanized steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
121	Fire Damper Housing	SRE, SNS, FB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
122	Fire Damper Housing	SRE, SNS, FB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
123	Fire Damper Housing 2M15	SRE, SNS, FB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
124	Fire Damper Housing 2M15	SRE, SNS, FB	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
125	Fire door and barriers	FB, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.A-21	3.3.1-59	A
126	Fire door and barriers	FB, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
127	Fire hose reels	SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
128	Fire proofing	FB, SRE	Pyrocrete	Air – indoor, uncontrolled (Ext)	Cracking	Fire Protection	N/A	N/A	F, 505
129	Fire proofing	FB, SRE	Pyrocrete	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	N/A	N/A	F, 505
130	Fire stops	FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Fire Protection	VII.G.A-19	3.3.1-57	A, 515
131	Fire stops	FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Fire Protection	III.A6.TP-7	3.5.1-72	E
132	Fire stops	FB, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
133	Fire wrap	FB, SRE	3M Interam	Air – indoor, uncontrolled (Ext)	Change in material properties	Fire Protection	N/A	N/A	F, 502
134	Fire wrap	FB, SRE	3M Interam	Air – indoor, uncontrolled (Ext)	Cracking/Delamination	Fire Protection	N/A	N/A	F, 502
135	Fire wrap	FB, SRE	3M Interam	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	N/A	N/A	F, 502

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
136	Fire wrap	FB, SRE	Fiberglass/ Alumina silicate/ Calcium silicate/ Mineral fiber	Air – indoor, uncontrolled (Ext)	None	None	N/A	N/A	F, 503
137	Flapper Valve Diesel Generator Room	FLB	Steel	Raw water (Int)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
138	Flashing	SNS, SRE, SSR	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
139	Flood Curb Aluminum 1	FLB, SNS	Aluminum	Air – indoor, uncontrolled (Ext)	None	Structures Monitoring	III.B5.TP-8	3.5.1-95	E, 514
140	Flood curbs	FB,FLB, SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
141	Flood curbs	FB,FLB, SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
142	Flood curbs	FLB, SNS	Aluminum	Air – outdoor (Ext)	Cracking	Structures Monitoring	V.E.E-406 (LR-ISG-2012-02)	3.2.1-71	E
143	Flood curbs	FLB, SNS	Aluminum	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
144	Flood curbs	FLB, SNS	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
145	Flood curbs	FLB, SNS	Elastomer	Air – outdoor (Ext)	Cracking	Structures Monitoring	II.B4.CP-41	3.5.1-33	E

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
146	Flood curbs	FLB, SNS	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
147	Flood curbs 1	FLB, SNS	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
148	Flood curbs 1	FLB, SNS	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
149	Flood curbs 1	FLB, SNS	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
150	Flood curbs 1	FLB, SNS	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
151	Flood curbs 3	FLB, SNS	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Structures Monitoring	II.B4.CP-40	3.5.1-26	E
152	Flood curbs 3	FLB, SNS	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B4.CP-40	3.5.1-26	E
153	Flood curbs 3	FLB, SNS	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	II.A3.CP-40	3.5.1-26	E
154	Flood, pressure and specialty doors	EN, FLB, MB, SPB	Glass	Air – indoor, uncontrolled (Ext)	None	None	VIII.I.SP-9	3.4.1-55	C
155	Flood, pressure and specialty doors	EN, FLB, MB, SPB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
156	Flood, pressure and specialty doors	EN, FLB, MB, SPB, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
157	Flood, pressure and specialty doors1	EN, FLB, MB, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Structures Monitoring	II.B4.CP-40	3.5.1-26	E
158	Flood, pressure and specialty doors1	EN, FLB, MB, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	II.B4.CP-41	3.5.1-33	E
159	Flood, pressure and specialty doors1	EN, FLB, MB, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	II.B4.CP-41	3.5.1-33	E
160	Floor grating (including studs, wire rope and connectors)	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
161	Fuel and Cont. Pool Liner,Skimmer Plts.,Scupper Boxes	DF,SSR	Stainless steel	Treated water (Int)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
162	Fuel Handling Platform	SNS,SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	VII.A1.A-94	3.3.1-111	A
163	Fuel Handling Platform1	SNS,SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
164	Fuel Handling Platform2	SNS,SSR	Stainless Steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	D
165	Fuel Prep Machine	SNS,SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A
166	Fuel Prep Machine1	SNS,SSR	Stainless Steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	D
167	General Purpose Grapple	SNS,SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A
168	General Purpose Grapple1	SNS,SSR	Stainless Steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	D
169	HVAC Duct	SNS, SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A
170	HVAC Duct 1	SNS, SSR	Galvanized Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A
171	HVAC duct supports	SNS, SSR	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
172	Instrument line supports	SNS, SRE, SSR	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
173	Instrument line supports	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
174	Instrument line supports	SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
175	Instrument racks, frames and tubing trays	SNS, SRE, SSR	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
176	Instrument racks, frames and tubing trays	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
177	Insulation	SNS	Fiberglass/ Alumina silicate/ Calcium silicate/ Mineral fiber	Air – indoor, uncontrolled (Ext)	None	None	N/A	N/A	F, 503
178	Insulation	SNS	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	External Surfaces Monitoring of Mechanical Components	VII.F3.AP-102	3.3.1-76	C
179	Insulation	SNS	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
180	Insulation	SNS	Elastomer	Air – outdoor (Ext)	Cracking	Structures Monitoring	II.B4.CP-41	3.5.1-33	E

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
181	Insulation	SNS	Fiberglass/ Alumina silicate/ Calcium silicate/ Mineral fiber	Air – outdoor (Ext)	None	None	N/A	N/A	F, 503
182	Insulation jacketing	SNS	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	C, 506
183	Insulation jacketing	SNS	Aluminum	Air – outdoor (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components	V.E.E-406 (LR-ISG-2012-02)	3.2.1-71	A
184	Insulation jacketing	SNS	Aluminum	Air – outdoor (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components	VII.I.AP-256	3.3.1-81	C
185	Insulation jacketing	SNS	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	C
186	Insulation jacketing	SNS	Stainless steel	Air – outdoor (Ext)	Cracking	Structures Monitoring	II.B4.CP-37	3.5.1-27	E
187	Insulation jacketing	SNS	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
188	Kellem's Grips	SRE	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
189	Lifting Lugs	SNS, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	C
190	Louver and Damper housings including 2M49 Fire Dampers	SRE, SNS, FB	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
191	Louver and Damper housings including 2M49 Fire Dampers	SRE, SNS, FB	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
192	Louver and Damper housings including 2M49 Fire Dampers1	SRE, SNS, FB	Galvanized Steel	Air – indoor, uncontrolled (Int)	None	None	III.B1.1.TP-8	3.5.1-95	A
193	Manway, hatches, manhole covers and hatch covers	EN, FLB, MB, SPB, SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
194	Manway, hatches, manhole covers and hatch covers	EN, FLB, MB, SPB, SNS, SRE, SSR	Steel	Air – outdoor (Int)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
195	Manway, hatches, manhole covers and hatch covers	FB	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Fire Protection and Structures Monitoring	VII.G.A-90	3.3.1-60	A
196	Manway, hatches, manhole covers and hatch covers	FLB, SPB, SNS, SRE, SSR	Concrete	Air – indoor, uncontrolled (Int)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
197	Manway, hatches, manhole covers and hatch covers	FLB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
198	Manway, hatches, manhole covers and hatch covers	FLB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
199	Manway, hatches, manhole covers and hatch covers	FLB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
200	Manway, hatches, manhole covers and hatch covers	FLB, SPB, SNS, SRE, SSR	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
201	Metallic (mirror) insulation	SNS	Aluminum	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	C
202	Metallic (mirror) insulation	SNS	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
203	Missile shields	MB	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
204	Missile shields	MB	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
205	Missile shields1	MB	Concrete	Air – outdoor (Ext)	Change in material properties	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
206	Missile shields1	MB	Concrete	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-28	3.5.1-67	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
207	Missile shields1	MB	Concrete	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
208	Missile shields1	MB	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
209	New Fuel Inspection Stand	SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A
210	Non-ASME bolting for in- scope piping, ductwork, components, and supports, including electrical applications;	SSR, SNS, SRE	Stainless Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-274	3.5.1-82	A
211	Non-ASME bolting for in- scope piping, ductwork, components, and supports, including electrical applications;	SSR, SNS, SRE	Stainless Steel	Air – outdoor (Ext)	Loss of preload	Structures Monitoring	III.B2.TP-261	3.5.1-88	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
212	Non-ASME bolting for in- scope piping, ductwork, components, and supports, including electrical applications1	SNS,SSR, SRE	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B1.1.TP-8	3.5.1-95	A
213	Non-ASME bolting for in- scope piping, ductwork, components, and supports, including electrical applications2	SNS,SSR, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B2.TP-248	3.5.1-80	A
214	Non-ASME bolting for in- scope piping, ductwork, components, and supports, including electrical applications3	SNS,SSR, SRE	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-274	3.5.1-82	A
215	Nuts/washers for in-scope anchorage/ embedments	SNS,SSR, SRE	Galvanized Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B1.1.TP-8	3.5.1-95	A
216	Nuts/washers for in-scope anchorage/ embedments1	SNS,SSR, SRE	Galvanized Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A1.TP-274	3.5.1-82	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
217	Nuts/washers for in-scope anchorage/ embedments2	SNS,SSR, SRE	Stainless Steel	Air – outdoor (Ext)	Cracking	Structures Monitoring	II.B4.CP-37	3.5.1-27	E
218	Nuts/washers for in-scope anchorage/ embedments2	SNS,SSR, SRE	Stainless Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
219	Nuts/washers for in-scope anchorage/ embedments3	SNS,SSR, SRE	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A
220	Nuts/washers for in-scope anchorage/ embedments4	SNS,SSR, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B4.TP-274	3.5.1-82	A
221	Nuts/washers for in-scope anchorage/ embedments5	SNS,SSR, SRE	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-274	3.5.1-82	A
222	Oil Interceptor Tanks	FLB	Concrete	Raw water (Int)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-37	3.5.1-61	A
223	Oil Interceptor Tanks	FLB	Concrete	Raw water (Int)	Cracking	Structures Monitoring	III.A1.TP-212	3.5.1-65	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
224	Oil Interceptor Tanks	FLB	Concrete	Raw water (Int)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
225	Oil Interceptor Tanks	FLB	Concrete	Soil (Ext)	Change in material properties	Structures Monitoring	III.A6.TP-107	3.5.1-67	A
226	Oil Interceptor Tanks	FLB	Concrete	Soil (Ext)	Cracking	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
227	Oil Interceptor Tanks	FLB	Concrete	Soil (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
228	Oil Interceptor Tanks Steel	FLB	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
229	Penetration sealant (fire)	EN, FB, FLB, SPB, SNS, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Fire Protection	VII.G.A-19	3.3.1-57	A
230	Penetration sealant (fire)	EN, FB, FLB, SPB, SNS, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	Fire Protection	VII.G.A-19	3.3.1-57	A
231	Penetration sealant (fire)	EN, FB, FLB, SPB, SNS, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Fire Protection	III.A6.TP-7	3.5.1-72	E, 522
232	Penetration sealant (fire)	EN, FB, FLB, SPB, SNS, SRE	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
233	Penetration sealant (fire)	EN, FB, FLB, SPB, SNS, SRE	Fiberglass/ Alumina silicate/ Calcium silicate/ Mineral fiber	Air – indoor, uncontrolled (Ext)	None	None	N/A	N/A	F, 503
234	Penetration sealant (fire)	EN, FB, FLB, SPB, SNS, SRE	Unimpregnated fiberglass fabric; Fiberglass fabric impregnated with elastomer	Air – indoor, uncontrolled (Ext)	Change in Material Properties and Cracking	Fire Protection and Structures Monitoring	N/A	N/A	F, 517
235	Penetration sealant (flood, radiation)	EN, FLB, SPB, SNS, SRE, SHD	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	External Surfaces Monitoring of Mechanical Components	II.B4.CP-41	3.5.1-33	E
236	Penetration sealant (flood, radiation)	EN, FLB, SPB, SNS, SRE, SHD	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
237	Penetration sealant (flood, radiation)	EN, FLB, SPB, SNS, SRE, SHD	Fiberglass/ Alumina silicate/ Calcium silicate/ Mineral fiber	Air – indoor, uncontrolled (Ext)	None	None	N/A	N/A	F, 503

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
238	Penetration Sealant Flood	EN, FLB, SNS	Elastomer	Raw water (Ext)	Cracking	Structures Monitoring	N/A	N/A	H, 524
239	Penetration sleeve seal plates (mechanical/electrical not penetrating primary containment boundary)	FLB, SSR, SNS	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
240	Penetration sleeve seal plates (mechanical/electrical not penetrating primary containment boundary)	FLB, SSR, SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
241	Penetration sleeves (mechanical/electrical not penetrating primary containment boundary)	FLB, SSR, SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
242	Penetration sleeves (mechanical/electrical not penetrating primary containment boundary)	FLB, SSR, SNS	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
243	Pipe Plug	FLB	Steel	Air – indoor, uncontrolled (Int)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C
244	Pipe whip restraints	SSR, SNS, EN	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
245	Pipe whip restraints	SSR, SNS, EN	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
246	Protect Tubes for Supp Pool Temp Elements	SSR,SNS	Stainless steel	Treated water (Ext)	Loss of material	Water Chemistry	III.A5.T-14	3.5.1-78	B
247	Radiant Barrier	SSR, SNS, EN	Stainless steel	Air – indoor, uncontrolled (Ext)	None	None	III.B3.TP-8	3.5.1-95	A
248	Radiant energy shield	FB, SRE	3M Interam	Air – indoor, uncontrolled (Ext)	Change in material properties	Fire Protection	N/A	N/A	F, 502
249	Radiant energy shield	FB, SRE	3M Interam	Air – indoor, uncontrolled (Ext)	Cracking/Delamination	Fire Protection	N/A	N/A	F, 502

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
250	Radiant energy shield	FB, SRE	3M Interam	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	N/A	N/A	F, 502
251	Rain guard	SNS	Stainless steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	A
252	Refueling Platform	SSR,SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	VII.A1.A-94	3.3.1-111	A
253	Refueling Platform1	SNS,SSR	Stainless Steel	Air – indoor, uncontrolled (Ext)	None	None	III.B5.TP-8	3.5.1-95	A
254	Refueling Platform2	SNS,SSR	Stainless Steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	VIII.D2.SP-87	3.4.1-16	D
255	Roof Drain Strainers	FLB	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	A
256	Roof Drain Strainers	FLB	Steel	Raw water (Int)	Flow Blockage	Structures Monitoring	N/A	N/A	H, 530
257	Roof Drain Strainers	FLB	Steel	Raw water (Int)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
258	Roof membrane	EN, SNS	Elastomer	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
259	Roof membrane1	EN, SNS	Elastomer	Raw water (Ext)	Cracking	Structures Monitoring	N/A	N/A	H, 524

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
260	Roof Scuppers, Roof Parapet Gaps (Concrete)	FLB,EN,SNS	Concrete	Raw water (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
261	Roof Scuppers, Roof Parapet Gaps (Concrete)	FLB,EN,SNS	Concrete	Raw water (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
262	Roof Scuppers, Roof Parapet Gaps (Concrete)	FLB,EN,SNS	Concrete	Raw water (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
263	Roof Scuppers, Roof Parapet Gaps (Concrete)1	FLB,EN,SNS	Concrete	Air – outdoor (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
264	Roof Scuppers, Roof Parapet Gaps (Concrete)1	FLB,EN,SNS	Concrete	Air – outdoor (Ext)	Cracking	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
265	Roof Scuppers, Roof Parapet Gaps (Concrete)1	FLB,EN,SNS	Concrete	Air – outdoor (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
266	Roof Scuppers, Roof Parapet Gaps (Concrete)1	FLB,EN,SNS	Concrete	Air – outdoor (Ext)	Loss of material (Corrosion of embedded steel reinforcing)	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-38	3.5.1-59	A
267	Roof Scuppers, Roof Parapet Gaps, Carbon Steel	FLB,EN,SNS	Steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
268	Roof Scuppers, Roof Parapet Gaps, Carbon Steel1	FLB,EN,SNS	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C
269	Roof Scuppers, Roof Parapet Gaps, Steel	FLB,EN,SNS	Stainless steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	C, 511

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
270	Roof Scuppers, Roof Parapet Gaps, Steel1	FLB,EN,SNS	Stainless Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	C
271	Sanitary Fixtures inside the Control Room	EN,SPB	Porcelain	Air – indoor, uncontrolled (Ext)	None	None	N/A	N/A	H, 520
272	Sanitary Fixtures inside the Control Room1	EN,SPB	Porcelain	Raw water (Ext)	None	None	N/A	N/A	H, 520
273	Scaffolds	EN,SSR,SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	C
274	Seals and gaskets (doors, manways and hatches)	FLB, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	External Surfaces Monitoring of Mechanical Components	II.B4.CP-41	3.5.1-33	E
275	Seals and gaskets (doors, manways and hatches)	FLB, SPB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
276	Seals and gaskets (doors, manways and hatches)	FLB, SPB, SSR	Elastomer	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
277	Seismic isolation joint	FB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	External Surfaces Monitoring of Mechanical Components	II.B4.CP-41	3.5.1-33	E

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
278	Seismic isolation joint	FB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Fire Protection	VII.G.A-19	3.3.1-57	C
279	Seismic isolation joint	FB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Fire Protection	III.A6.TP-7	3.5.1-72	E, 522
280	Seismic isolation joint	FB, SSR	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
281	Shielding	SHD, SNS	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
282	Shielding	SHD, SNS	Elastomer	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
283	Shielding	SHD, SNS	Unimpregnated fiberglass fabric; Fiberglass fabric impregnated with elastomer	Air – indoor, uncontrolled (Ext)	Change in Material Properties and Cracking	Structures Monitoring	N/A	N/A	J, 523
284	Sliding support	SSR	Lubrite®/ Fluorogold®	Air – indoor, uncontrolled (Ext)	Change in material properties	Structures Monitoring	N/A	N/A	H, 525

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
285	Sliding support	SSR	Lubrite®/ Fluorogold ®	Air – indoor, uncontrolled (Ext)	Loss of mechanical function	Structures Monitoring	III.A4.TP-35	3.5.1-76	A
286	SRV Tailpipe Penetration Boot Seals	EN, FB, FLB, SPB, SNS	Unimpregnated fiberglass fabric; Fiberglass fabric impregnated with elastomer	Air – indoor, uncontrolled (Ext)	Change in Material Properties and Cracking	Fire Protection and Structures Monitoring	N/A	N/A	F, 517
287	Stairway, handrail, platform, grating, decking and ladders	SNS	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	A
288	Stairway, handrail, platform, grating, decking and ladders	SNS	Galvanized steel	Air – indoor, uncontrolled (Ext)	None	None	III.B2.TP-8	3.5.1-95	A
289	Storm Drain	FLB, SNS	Steel	Raw water (Int)	Flow Blockage	Structures Monitoring	N/A	N/A	H, 530
290	Storm Drain	FLB, SNS	Steel	Raw water (Int)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
291	Storm Drain	FLB, SNS	Steel	Soil (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
292	Storm Drain1	FLB,SNS	Polymer	Raw water (Int)	Loss of strength	Structures Monitoring	N/A	N/A	H, 526

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
293	Storm Drain1	FLB,SNS	Polymer	Soil (Ext)	Loss of strength	Structures Monitoring	N/A	N/A	H, 526
294	Storm Drain3	FLB,SNS	Concrete	Raw water (Int)	Flow Blockage	Structures Monitoring	N/A	N/A	H, 530
295	Storm Drain3	FLB,SNS	Concrete	Raw water (Int)	Loss of material	Structures Monitoring	N/A	N/A	H, 531
296	Storm Drain3	FLB,SNS	Concrete	Soil (Ext)	Loss of material	Structures Monitoring	N/A	N/A	H, 531
297	Structural bolting	SNS, SRE, SSR	High strength steel	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-300	3.5.1-69	A
298	Structural bolting	SNS, SRE, SSR	High strength steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-248	3.5.1-80	A
299	Structural bolting	SNS, SRE, SSR	High strength steel	Air – outdoor (Ext)	Cracking	Structures Monitoring	III.A3.TP-300	3.5.1-69	A
300	Structural bolting	SNS, SRE, SSR	High strength steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-274	3.5.1-82	A
301	Structural bolting	SNS, SRE, SSR	High strength steel	Raw water (Ext)	Cracking	Structures Monitoring	III.A3.TP-300	3.5.1-69	A
302	Structural bolting	SNS, SRE, SSR	High strength steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.A3.TP-274	3.5.1-82	A
303	Structural bolting	SNS, SRE, SSR	Stainless steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Structures Monitoring	III.A3.TP-261	3.5.1-88	A

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
304	Structural bolting	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-248	3.5.1-80	A
305	Structural bolting	SNS, SRE, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of preload	Structures Monitoring	III.A3.TP-261	3.5.1-88	A
306	Structural bolting	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of material	Structures Monitoring	III.A3.TP-274	3.5.1-82	A
307	Structural bolting	SNS, SRE, SSR	Steel	Air – outdoor (Ext)	Loss of preload	Structures Monitoring	III.A3.TP-261	3.5.1-88	A
308	Structural bolting	SNS, SRE, SSR	Steel	Raw water (Ext)	Cracking	Structures Monitoring	N/A	N/A	H, 519
309	Structural bolting	SNS, SRE, SSR	Steel	Raw water (Ext)	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	C
310	Structural Bolting 1	SNS, SRE, SSR	Stainless Steel	Treated water (Ext)	Loss of material	Structures Monitoring	III.A5.T-14	3.5.1-78	E
311	Structural bolting 2	SNS, SRE, SSR	High strength steel	Treated water (Ext)	Cracking	Structures Monitoring	N/A	N/A	G, 512
312	Structural bolting 2	SNS, SRE, SSR	High strength steel	Treated water (Ext)	Loss of material	Structures Monitoring	N/A	N/A	G, 519
313	Structural bolting 3	SNS, SRE, SSR	Steel	Treated water (Ext)	Loss of material	Water Chemistry and One-Time Inspection	II.B2.1.CP-63	3.5.1-5	E

Table 3.5.2-4 - Bulk Commodities

Row	Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
314	Support members: welds; support anchorages to building structure	EN, SNS, SSR, SRE	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
315	Support pedestals	SNS, SRE, SSR	Concrete	Air – indoor, uncontrolled (Ext)	Cracking	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
316	Tefzel Ties	SNS	Elastomer	Air – indoor, uncontrolled (Ext)	Change in material properties and cracking	Structures Monitoring	VII.F1.AP-102	3.3.1-76	E, 510
317	Tornado depressurization duct blank-off plates	SNS,SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A1.TP-302	3.5.1-77	A
318	Tornado Doors	SRE, FB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Fire Protection	VII.G.A-21	3.3.1-59	A
319	Tornado Doors	SRE, FB, SSR	Steel	Air – indoor, uncontrolled (Ext)	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
320	Water stops	FLB	Elastomer	Air – indoor, uncontrolled (Ext)	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
321	Waterproofing Membranes	EN, FLB	Elastomer	Concrete (Int)	Cracking	Structures Monitoring	N/A	N/A	H, 527
322	Waterproofing Membranes	EN, FLB	Elastomer	Soil (Ext)	Cracking	Structures Monitoring	N/A	N/A	H, 524

Table 3.5.2-4 - Bulk Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
323	Waterproofing Membranes1	EN, FLB	Elastomer	Raw water (Ext)	Cracking	Structures Monitoring	N/A	N/A	H, 524
324	Wooden Clamps	SSR, SNS, SRE	Wood	Air – outdoor (Ext)	Change in material properties	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-223	3.5.1-62	E, 509
325	Wooden Clamps	SSR, SNS, SRE	Wood	Air – outdoor (Ext)	Loss of material	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6.TP-223	3.5.1-62	E, 509

Notes for Table 3.5.2-1 through Table 3.5.2-4

Standard Notes

A	Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material, and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination are evaluated in NUREG-1801.

Plant-Specific Notes

501	The Structures Monitoring program will manage aging of stainless steel roof scuppers exposed to outdoor air.
502	The Fire Protection program will manage aging effects for 3M Interam, which is a flexible mat that releases chemically bound water to slow heat transfer at high temperature.
503	Operating experience review did not identify aging effects that affect intended function for these material / environment combinations.
504	Not used
505	The Fire Protection program will manage aging of pyrocrete in this environment.
506	While aging effects are not expected for aluminum insulation jacketing in indoor air, the External Surfaces Monitoring program directs inspections of insulation on applicable in-scope piping components.

507	No aging effect per EPRI Report 1015078, Plant Support Engineering: Aging Effects for Structures and Structural Components (Structural Tools), Revision 2, Table 10-7.
508	Not used
509	At PNPP, Maple wood blocks are used in supporting electrical cables in manholes.
510	At PNPP, Tefzel Ties (ETFE) aging effects of change in material/cracking will be managed by the Structures Monitoring Program (S6).
511	The aging effects are conservatively based upon raw water environment. However, these components are exposed primarily to Air - Outdoor with periods of precipitation. This environment is considered equivalent for the purposes of this line item.
512	Treated water environment is considered similar to air for the cracking aging effect
513	Grounding bar is embedded deep in concrete. No aging management performed.
514	Deployable flood barriers are made of aluminum and are stored inside the buildings while not needed. They are deployed outside with flood warnings.
515	Program is capable of detecting cracking.
516	Air-indoor (ext) is indicative of internal conditions.
517	Material not in GALL. Material difference does not prevent detection of aging effects by the Fire Protection and Structures Monitoring program.
518	Aging effect per EPRI Report 1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tool (Mechanical Tools), Revision 4, Appendix E, Section 3.6.2. Loss of strength does not fail the function. The loading on the cap to perform the function is minor. As long as the cap is visually leaktight, the function is ensured.
519	Structural Monitoring Program will detect this aging effect. Structural Tools Table 4-3 provides the basis for cacking in steel bolting and Table 3-3 provides the basis for loss of material.
520	Based on Industry OE, porcelain in waste water and air has no aging effect in waste water or air. PNPP internal OE supports this conclusion.
521	Galvanized steel is being treated as steel in this case.
522	Structures Monitoring Program is aligned with Fire Protection Program in detecting the loss of sealing aging effect for this material/environment combination.
523	Aging effect identified per Structural Tools, Revision 2, Table 7-5. Structural monitoring program will detect this aging effect.
524	Aging effect identified per Structural Tools Table 6-3. Structural monitoring will detect this aging effect.

525 Aging effect identified per Structural Tools, Table 9-2.

526 Aging effect identified per EPRI Mechanical Tools, Appendix E, Section 3.6.2. Structures Monitoring will detect this aging effect.

527 Aging effect identified per Structural Tools Table 7-5. Structural monitoring program will detect this aging effect.

528 Aging effect identified per EPRI Mechanical Tools, Appendix A, Table 4-1.

529 Periodic cleaning of intake structures and tunnel is performed as part of Structures Monitoring Program.

530 Walkdowns performed as part of Structural Monitoring Program will detect and address signs of flow blockage in these component types.

531 Loss of material will be detected based on periodic excavations for storm drain piping and visual inspections performed as part of Structures Monitoring program.

3.6 AGING MANAGEMENT OF ELECTRICAL COMMODITIES

3.6.1 INTRODUCTION

This section provides the results of the aging management review for the electrical commodity groups identified in Section 2.5. Consistent with the methods described in NEI 95-10, the electrical and I&C aging management reviews focus on commodity groups rather than systems. The following electrical commodity groups requiring aging management review are addressed in this section.

- Non-EQ insulated cables and connections
    - Cable connections (metallic parts)
    - Electrical cables and connections not subject to 10 CFR 50.49 EQ Requirements
    - Inaccessible power (greater than or equal to 400V) cables (e.g., embedded conduit or installed underground in conduit or duct bank) not subject to 10 CFR 50.49 EQ requirements
    - Insulation material for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits
    - Fuse Holders (not part of active equipment)
- High-voltage insulators
- Switchyard bus and connections
- Transmission Conductors
- Transmission Connectors

Table 3.6.1, Summary of Aging Management Programs for Electrical Components Evaluated in Chapter VI of NUREG-1801, provides the summary of the aging management reviews and the programs evaluated in NUREG-1801 for the electrical and I&C commodities.

3.6.2 RESULTS

Table 3.6.2, Electrical Commodities—Summary of Aging Management Evaluation, summarizes the results of aging management reviews and the NUREG-1801 comparison for Electrical and I&C Commodities.

3.6.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for electrical and I&C components subject to aging management review. Programs are described in Appendix B. Further details are provided in Table 3.6.2.

3.6.2.1.1 Cable Connections (metallic parts) (Section 2.5.5.1)

Materials

The material of construction for the cable connections (metallic parts) is:

- Various metals used for electrical contacts

Environment

The cable connections (metallic parts) are exposed to the following environments:

- Air Outdoor
- Air Indoor Controlled and Uncontrolled

Aging Effects Requiring Management

The following cable connections (metallic parts) aging effect requires management:

- Increased resistance of connection

Aging Management Programs

The following aging management program manages the aging effect for the cable connections (metallic parts)

- Non-EQ Electrical Cable Connections (B.2.31)

3.6.2.1.2 Non-EQ Insulated Cable and Connections (Section 2.5.5.1)

Materials

The material of construction for the Non-EQ insulated cable and connections is:

- Various Organic Polymers

Environment

The Non-EQ insulated cable and connections are exposed to the following environments:

- Adverse Localized Environment

Aging Effects Requiring Management

The following Non-EQ insulated electrical cable and connections aging effects requires management:

- Reduced insulation resistance

Aging Management Programs

The following aging management program manages the aging effect for the Non-EQ insulated cable and connections.

- Non-EQ Insulated Cables and Connections (B.2.34)

3.6.2.1.3 Non-EQ inaccessible power cables (Sections 2.5.5.1)

Materials

The material of construction for the Non-EQ inaccessible power cables is:

- Various Organic Polymers

Environment

The Non-EQ inaccessible power cables are exposed to the following environments:

- Adverse Localized Environment

Aging Effects Requiring Management

The following Non-EQ inaccessible power cables aging effects requires management:

- Reduced insulation resistance

Aging Management Programs

The following aging management program manages the aging effect for the Non-EQ inaccessible power cables.

- Non-EQ Inaccessible Power Cables (B.2.32)

3.6.2.1.4 Non-EQ instrument circuits (Sections 2.5.5.1)

Materials

The material of construction for the Non-EQ instrument circuits is:

- Various Organic Polymers

Environment

The Non-EQ instrument circuits are exposed to the following environments:

- Adverse Localized Environment

Aging Effects Requiring Management

The following Non-EQ instrument circuits aging effects require management:

- Reduced insulation resistance

Aging Management Programs

The following aging management program manage the aging effect for the Non-EQ electrical cables and connections in instrumentation circuits.

- Non-EQ Instrumentation Circuits (B.2.33)

3.6.2.1.5 Fuse Holders (not part of active equipment) (Section 2.5.5.2)

All fuse holders are located in mild environments which contain no sources of vibration. The fuse holders are not subject to frequent manipulation. The aging mechanism of fatigue due to frequent manipulation or vibration is not applicable.

Materials

The material of construction for the fuse holders (metallic parts) is:

- Various metals used for electrical connections

Environment

The fuse holders (not part of active equipment) are exposed to the following environments:

- Air Indoor Controlled and Uncontrolled

Aging Effects Requiring Management

The following fuse holder (metallic parts) aging effects requires management:

- Increased resistance of connection due to chemical contamination, corrosion, and oxidation
- Fatigue due to ohmic heating, thermal cycling, or electrical transients

Aging Management Programs

The following aging management program manages the aging effect for the fuse holder (metallic parts)

- Fuse Holders (B.2.24)

3.6.2.1.6 High Voltage Insulators (Section 2.5.5.4)

Materials

The materials of construction for the high voltage insulators are:

- Porcelain
- Cement (Electrical Insulators)
- Silicone (Electrical Insulators)
- Galvanized Steel

Environment

The high voltage insulators are exposed to the following environments:

- Air Outdoor

Aging Effects Requiring Management

The following high voltage insulator aging effects require management:

- None

Aging Management Programs

The following aging management program manages the aging effect for high voltage insulators.

- None

3.6.2.1.7 Switchyard Bus and Connectors (Section 2.5.5.3)

Materials

The materials of construction for the switchyard bus and connectors are:

- Aluminum
- Stainless Steel

Environment

The switchyard bus and connectors are exposed to the following environments:

- Air Outdoor

Aging Effects Requiring Management

The following switchyard bus and connectors aging effects require management:

- None

Aging Management Programs

The following aging management program manages the aging effect for switchyard bus and connectors.

- None

3.6.2.1.8 Transmission Conductors (Section 2.5.5.3)

Materials

The materials of construction for the Transmission conductors are:

- Aluminum
- Aluminum Conductor Steel Reinforced

Environment

The Transmission conductors are exposed to the following environments:

- Air Outdoor

Aging Effects Requiring Management

The following Transmission conductors aging effects require management:

- None

Aging Management Programs

The following aging management program manages the aging effect for Transmission conductors.

- None

3.6.2.1.9 Transmission Connectors (Section 2.5.5.3)

Materials

The materials of construction for the Transmission connectors are:

- Aluminum
- Stainless Steel

Environment

The Transmission connectors are exposed to the following environments:

- Air Outdoor

Aging Effects Requiring Management

The following Transmission connectors aging effects require management:

- None

Aging Management Programs

The following aging management program manages the aging effect for Transmission connectors.

- None

3.6.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1800 provides the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Electrical Commodities, those programs are addressed in the following subsections.

Note - Italicized text at the beginning of each Further Evaluation subsection is taken directly from NUREG-1800 as supplemented by LR-ISG-2011-05.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

Environmental qualification is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is addressed separately in Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," of this SRP-LR.

Electrical equipment environmental qualification (EQ) analyses may be TLAAs as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of EQ TLAAs are addressed in the TLAA Section 4.4 of the LRA. EQ components are subject to replacement based on a qualified life. Therefore, in accordance with 10 CFR 54.21(a)(1)(ii), EQ components are not subject to aging management review.

3.6.2.2.2 Reduced Insulation Resistance due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material due to Mechanical Wear Caused by Wind Blowing on Transmission Conductors

Reduced insulation resistance due to presence of any salt deposits and surface contamination could occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind blowing on transmission conductors could occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

PNPP is located in an area with moderate rainfall and where the outdoor environment is not subject to industry air pollution or salt spray. The glazed insulator surface is designed to minimize adherence of pollution and salt spray. Periodic rainfall is sufficient to remove contaminants from the high-voltage insulators. PNPP has experienced no instance of flashover due to pollution or salt contamination. Reduced insulation resistance due to the presence of salt deposits and surface contamination on high voltage insulators supporting transmission conductors is not an aging effect requiring management.

Industry experience has shown that transmission conductors are designed and installed to reduce swing significantly and subside after a short period. The PNPP transmission conductors are designed and installed not to swing significantly and cause wear due to wind induced abrasion and fatigue. Therefore, loss of material due to wind induced abrasion and fatigue on high voltage insulators supporting transmission conductors is not an applicable aging effect requiring management.

3.6.2.2.3 Loss of Material due to Wind-Induced Abrasion, Loss of Conductor Strength due to Corrosion, and Increased Resistance of Connection due to Oxidation or Loss of Pre-load

Loss of material due to wind-induced abrasion, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load could occur in transmission conductors and connections, and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

<u>Loss of Material due to Wind-Induced Abrasion</u>

Industry experience has shown that transmission conductors are designed and installed not to swing significantly and cause wear due to wind induced abrasion and fatigue. Maintenance practices include periodic inspection of transmission conductors and connections. Therefore, loss of material due to wind induced abrasion and fatigue is not an aging effect that requires a plant-specific aging management program for the period of extended operation.

PNPP Switchyard bus is rigid aluminum, with aluminum clamps securely fastened with stainless steel nuts and bolts to a rigid support structure. Loss of material due to wind induced abrasion does not require a plant-specific aging management program for the period of extended operation.

<u>Loss of Conductor Strength due to Corrosion</u>

The PNPP outdoor environment is not subject to industry air pollution or saline environment. Aluminum conductors, bus material, stainless steel support hardware and aluminum connection material do not experience any appreciable aging effects in this environment. PNPP has 3500 kcmil all aluminum conductor (AAC) between the bus and the first tower leaving the switchyard to the step-up station. AAC has no aging effects that require aging management. The AAC cables at PNPP are not subject to either severe corrosion or reduction in tensile strength due to aging. Therefore, corrosion of the AAC is not a credible aging effect that requires aging management for the period of extended operation.

NUREG-1800 requires an evaluation of the need for a plant-specific aging management program for aluminum conductor, steel reinforced (ACSR). The transmission conductors from the switchyard towers to the startup transformers are dual 1590 kcmil aluminum conductor, steel reinforced (ACSR).

The most prevalent mechanism contributing to loss of conductor strength is corrosion. Corrosion rates depend largely on air quality, which involves suspended particles in the air, SO_2 concentration, rain, fog chemistry, and other weather conditions. The PNPP environment is not subject to industrial or salt pollution. USAR Section 2.3.1.2.6 shows there is a low frequency and duration (24 cases of four days or more between 1936 to 1965) of high air pollution potential due to stagnating anticyclones with low average wind speeds, no precipitation and a shallow mixing depth at PNPP.

The IEEE Transactions on Power Delivery contain a two part paper on ACSR conductors, commonly referred to as the Ontario Hydro Study. In testing (Part I), the study found that even with heavy contamination, the aluminum wires were in good condition.

Part II of the Ontario Hydro Study concentrates on prediction of remaining life of ACSR cable. Laboratory testing consistently showed that, for ACSR cable, aluminum was found to have retained its original properties, for the most part, while the steel components showed reductions in tensile strength. The data also indicates that the reduction in strength was almost solely in the steel wires.

The National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60% of the rated breaking strength. The NESC also sets the maximum tension a conductor must be designed to withstand under heavy load requirements, which includes consideration of ice, wind, and temperature.

At PNPP, the ACSR transmission conductors are 45/7, 1590 KCM with a rated breaking strength of 42,200 lbs. The PNPP ACSR transmission conductors within the scope of license renewal are installed so that conductor final tension is a maximum of 5,606 lb does not exceed the NESC heavy loading condition (25 percent of the rated breaking strength) of 10,550 lbs.

Tests performed by Ontario Hydroelectric on ACSR transmission conductors with a core of seven steel strands averaging 70 to 80 years old showed a 30 percent loss of rated breaking strength due to corrosion. Assuming a 30 percent loss of rated breaking strength (12,660 lbs) due to corrosion over 60 years the PNPP ACSR transmission conductors have adequate design margin to offset the loss of strength due to corrosion and still meet the NESC requirement of not exceeding 60 percent of the rated breaking strength ((42,200 – 12,660) x 60 percent = 17,724 lbs). The Ontario Hydroelectric test envelopes the conductors at Callaway and based on the conservatism in strength margin, demonstrates that the material loss on the PNPP transmission conductors is acceptable for the period of extended operation. Therefore, corrosion of ACSR transmission conductors is not a credible aging effect that requires a plant-specific aging management program for the period of extended operation.

Increased Resistance of Connection due to Oxidation or Loss of Pre-Load

The PNPP outdoor environment is not subject to industry air pollution or saline environment. Aluminum switchyard bus material, stainless steel support hardware and aluminum connection material do not experience any appreciable aging effects in this environment. A plant-specific aging management program for oxidation or loss or pre-load on switchyard bus and connectors is not required.

Connection configuration includes compression or swage aluminum fittings and NEMA aluminum 4-bolt connectors. These connections are periodically evaluated via thermography as part of the preventive maintenance activities. Therefore, increased resistance of connections due to oxidation or loss of pre-load are not aging effects requiring a plant-specific aging management program for the period of extended operation.

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2 of this SRP-LR).

Quality Assurance Program and Administrative Controls are discussed in Appendix B, section B.1.3.

3.6.2.2.5 Ongoing Review of Operating Experience (per LR-ISG-2011-05)

Ongoing review of operating experience is addressed in Appendix A, Section A.1.

3.6.2.3 Time-Limited Aging Analyses

The time-limited aging analyses identified below are associated with the electrical and instrumentation and controls component types. The section within Chapter 4, *Time-Limited Aging Analyses*, is indicated in parenthesis.

- Environmental Qualification of Electrical and Instrumentation and Control Equipment (Section 4.4, *Environmental Qualification of Electric Equipment*)

3.6.3 CONCLUSIONS

The Electrical and Instrumentation and Controls component types that are subject to AMR have been evaluated. The aging management programs selected to manage the aging effects for the Electrical and Instrumentation and Controls component types are identified in the summary Tables and in Section 3.6.2.1.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-1	Electrical equipment subject to 10 CFR 50.49 EQ requirements composed of various polymeric and metallic materials exposed to adverse localized environment caused by heat, radiation, oxygen, moisture, or voltage	Various aging effects due to various mechanisms in accordance with 10 CFR 50.49	EQ is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.E1, "Environmental Qualification (EQ) of Electric Components," of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA	Environmental Qualification is a TLAA. See section 3.6.2.2.1 and Chapter 4, Section 4.4 for further evaluation.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-2	High-voltage insulators composed of porcelain; galvanized steel; cement exposed to air – outdoor	Loss of material due to mechanical wear caused by wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Plant specific evaluation in section 3.6.2.2.2. Loss of material due to mechanical wear caused by wind blowing on transmission conductors is not an applicable aging effect at PNPP.
3.6.1-3	High-voltage insulators composed of porcelain; galvanized steel; cement exposed to air – outdoor	Reduced insulation resistance due to presence of salt deposits or surface contamination	A plant-specific aging management program is to be evaluated for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution)	Yes, plant-specific	Plant specific evaluation in section 3.6.2.2.2. Reduced insulation resistance due to salt deposits or surface contamination is not an applicable aging effect at PNPP.
3.6.1-4	Transmission conductors composed of Aluminum; steel exposed to air – outdoor	Loss of conductor strength due to corrosion	A plant-specific aging management program is to be evaluated for ACSR	Yes, plant-specific	Plant specific evaluation in section 3.6.2.2.3. Loss of conductor strength due to corrosion for ACSR does not require management at PNPP.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-5	Transmission connectors composed of aluminum; steel exposed to air – outdoor	Increased resistance of connection due to oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Plant specific evaluation in section 3.6.2.2.3. Increased resistance of connection due to oxidation or preload does not require aging management at PNPP.
3.6.1-6	Switchyard bus and connections composed of aluminum; stainless steel; galvanized steel exposed to air – outdoor	Loss of material due to wind-induced abrasion; Increased resistance of connection due to oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Plant specific evaluation in section 3.6.2.2.3. Loss of material due to wind induced abrasion and increased resistance of connection aging effects do not require aging management at PNPP.
3.6.1-7	Transmission conductors composed of aluminum; steel exposed to air – outdoor	Loss of material due to wind-induced abrasion	A plant-specific aging management program is to be evaluated for ACAR and ACSR	Yes, plant-specific	Plant specific evaluation in section 3.6.2.2.3. Loss of material due to wind induced abrasion and fatigue does not require aging management at PNPP.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-8	Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by heat, radiation, or moisture.	Reduced insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion.	Chapter XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Consistent with NUREG-1801. The Non-EQ Insulated Cables and Connections (B.2.34) will manage reduced insulation resistance of the various organic polymer Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by heat, radiation, or moisture.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-9	Insulation material for electrical cables and connections used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance (IR) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by heat, radiation, or moisture	Reduced insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Chapter XI.E2, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits"	No	Consistent with NUREG-1801. The Non-EQ Instrumentation Circuits Program (B.2.33) will manage reduced insulation resistance of the various organic polymer for electrical cables and connections (including terminal blocks, fuse holders, etc.) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by heat, radiation, or moisture.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-10	Conductor insulation for inaccessible power cables greater than or equal to 400 volts (e.g., installed in conduit or direct buried) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by significant moisture	Reduced insulation resistance due to moisture	Chapter XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Consistent with NUREG-1801, the Non-EQ Inaccessible Power Cables (B.2.32) will manage reduced insulation resistance due to moisture of conductor insulation for inaccessible power cables greater than or equal to 400 volts composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by significant moisture..
3.6.1-11	Metal enclosed bus: enclosure assemblies composed of Elastomers exposed to Air – indoor, controlled or uncontrolled or Air – outdoor	Surface cracking, crazing, scuffing, dimensional change (e.g. “ballooning” and “necking”), shrinkage, discoloration, hardening and loss of strength due to elastomer degradation	Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Iso-phase bus is the only metal enclosed bus at PNPP and has no license renewal intended function. No aging management program is required. See 2.5.3.2.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-12	Metal enclosed bus: bus/connections composed of Various metals used for electrical bus and connections exposed to Air – indoor, controlled or uncontrolled or Air – outdoor	Increased resistance of connection due to the loosening of bolts caused by thermal cycling and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No	Iso-phase bus is the only metal enclosed bus at PNPP and has no license renewal intended function. No aging management program is required. See 2.5.3.2.
3.6.1-13	Metal enclosed bus: insulation; insulators composed of Porcelain; xenoy; thermo-plastic organic polymers exposed to Air – indoor, controlled or uncontrolled or Air – outdoor	Reduced insulation resistance due to thermal/thermoxidative degradation of organics/thermoplastics, radiation-induced oxidation, moisture/debris intrusion, and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No	Iso-phase bus is the only metal enclosed bus at PNPP and has no license renewal intended function. No aging management program is required. See 2.5.3.2.
3.6.1-14	Metal enclosed bus: external surface of enclosure assemblies composed of Steel exposed to Air – indoor, uncontrolled or Air – outdoor	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.S6, "Structures Monitoring"	No	Iso-phase bus is the only metal enclosed bus at PNPP and has no license renewal intended function. No aging management program is required. See 2.5.3.2.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-15	Metal enclosed bus: external surface of enclosure assemblies composed of Galvanized steel; aluminum exposed to Air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.S6, "Structures Monitoring"	No	Iso-phase bus is the only metal enclosed bus at PNPP and has no license renewal intended function. No aging management program is required. See 2.5.3.2.
3.6.1-16	Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor, uncontrolled	Increased resistance of connection due to chemical contamination, corrosion, and oxidation (in an air, indoor controlled environment, increased resistance of connection due to chemical contamination, corrosion and oxidation do not apply); fatigue due to ohmic heating, thermal cycling, electrical transients	Chapter XI.E5, "Fuse Holders"	No	Consistent with NUREG-1801. The Fuse Holders program (B.2.24) will manage increased resistance of connection of metallic clamps composed of various metals used for electrical connections exposed to air – indoor, uncontrolled.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-17	Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to Air – indoor, controlled or uncontrolled	Increased resistance of connection due to fatigue caused by frequent manipulation or vibration	Chapter XI.E5, "Fuse Holders" No aging management program is required for those applicants who can demonstrate these fuse holders are located in an environment that does not subject them to environmental aging mechanisms or fatigue caused by frequent manipulation or vibration	No	Fuse holders are not subject to environmental aging or fatigue caused by frequent manipulation or vibration. See 3.6.2.1.5.
3.6.1-18	Cable connections (metallic parts) composed of various metals used for electrical contacts exposed to air – indoor, controlled or uncontrolled or air – outdoor	Increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Chapter XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Consistent with NUREG-1801. The Non-EQ Electrical Cable Connections (B.2.31) will manage increased resistance of connection of Cable connections (metallic parts) composed of various metals used for electrical contacts exposed to air – indoor, controlled or uncontrolled or air – outdoor.

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-19	Connector contacts for electrical connectors exposed to borated water leakage composed of various metals used for electrical contacts exposed to Air with borated water leakage.	Increased resistance of connection due to corrosion of connector contact surfaces caused by intrusion of borated water	Chapter XI.M10, "Boric Acid Corrosion"	No	PWR Only, not applicable to PNPP.
3.6.1-20	Transmission conductors composed of aluminum, steel, exposed to air – outdoor	Loss of conductor strength due to corrosion	None - for Aluminum Conductor Aluminum Alloy Reinforced (ACAR)	None	PNPP has no ACAR cable

Table 3.6.1: Summary of Aging Management Evaluations for the Electrical Components Evaluated in Chapter VI of NUREG-1801					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-21	Fuse holders (not part of active equipment): insulation material, Metal enclosed bus: external surface of enclosure assemblies composed of insulation material: bakelite; phenolic melamine or ceramic; molded polycarbonate; other exposed to air – indoor, controlled or uncontrolled	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 Table 3.6-1 Rev 2 Item VI.A.LP-24. Insulation material for fuse holders outside of active equipment or metal enclosed bus has no aging effects and does not require aging management.

Table 3.6.2
Electrical Commodities
Summary of Aging Management Evaluation

3.6.2 – Electrical Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
1	Cable Connections (metallic parts)	Electrical continuity	Various metals used for electrical contacts	Air – indoor controlled or uncontrolled or Air - outdoor	Increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Non-EQ Electrical Cable Connections	VI.A.LP-30	3.6.1-18	A
2	Fuse holders (not part of active equipment): insulation material	Insulate (electrical)	Insulation material: bakelite; phenolic melamine or ceramic; molded polycarbonate; other	Air – indoor controlled or uncontrolled	None	None	VI.A.LP-24	3.6.1-21	A

3.6.2 – Electrical Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
3	Fuse holders (not part of active equipment): metallic clamps	Electrical continuity	Various metals used for electrical connections	Air – indoor controlled or uncontrolled	Increased resistance of connection due to chemical contamination, corrosion, and oxidation (in an air, indoor controlled environment, increased resistance of connection due to chemical contamination, corrosion and oxidation do not apply); fatigue due to ohmic heating, thermal cycling, electrical transients	Fuse Holders	VI.A.LP-23	3.6.1-16	A
4	Fuse holders (not part of active equipment): metallic clamps	Electrical continuity	Various metals used for electrical connections	Air – indoor controlled or uncontrolled	Increased resistance of connection due to fatigue caused by frequent manipulation or vibration	None	VI.A.LP-31	3.6.1-17	A, 601
5	High voltage insulators	Insulate (electrical)	Porcelain, galvanized steel, cement, silicone	Air - outdoor	Loss of material due to mechanical wear caused by wind on transmission conductors	None	VI.A.LP-32	3.6.1-2	A, 602

3.6.2 – Electrical Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
6	Insulation Material for Cables and Connections	Insulate (electrical)	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	–Adverse Localized Environment	Reduced insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Non-EQ Insulated Cables and Connections	VI.A.LP-33	3.6.1-8	A
7	High voltage insulators	Insulate (electrical)	Porcelain, galvanized steel, cement, silicone	Air - outdoor	Reduced insulation resistance due to presence of salt deposits or surface contamination	None	VI.A.LP-28	3.6.1-3	A, 603
8	Conductor insulation for inaccessible power cables greater than or equal to 400 volts (e.g., installed in conduit or direct buried)	Insulate (electrical)	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by significant moisture	Reduced insulation resistance due to moisture	Non-EQ Inaccessible Power Cables	VI.A.LP-35	3.6.1-10	A

3.6.2 – Electrical Commodities									
Row	**Component Type**	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
9	Conductor insulation for cables and connections used in instrumentation circuits	Insulate (electrical)	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by heat, radiation, or moisture	Reduced insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Non-EQ Instrumentation Circuits Program	VI.A.LP-34	3.6.1-9	A
10	Switchyard bus and connections	Electrical continuity	Aluminum, stainless steel	Air - outdoor	Loss of material due to wind-induced abrasion; Increased resistance of connection due to oxidation	None	VI.A.LP-39	3.6.1-6	A, 604
11	Transmission conductors	Electrical continuity	Aluminum, Aluminum conductor steel reinforced (ACSR)	Air - outdoor	Loss of conductor strength due to corrosion	None	VI.A.LP-38	3.6.1-4	A, 605
12	Transmission connectors	Electrical continuity	Aluminum, stainless steel	Air-outdoor	Increased resistance of connection due to oxidation or loss of pre-load	None	VI.A.LP-48	3.6.1-5	A, 606
13	Transmission conductors	Electrical continuity	Aluminum, Aluminum conductor steel reinforced (ACSR)	Air - outdoor	Loss of material due to wind-induced abrasion	None	VI.A.LP-47	3.6.1-7	A, 607

Notes for Table 3.6.2:

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 for component, material, environment, and aging effect, but a different AMP is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG 1801 for this component, material, and environment combination.

I. Aging effect in NUREG-1801 is not applicable for this component, material, and environment combination.

J. Neither the component, nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific Notes:

601 Fuse holder metallic clamps are not subject to frequent manipulation or vibration, no aging management program is required, see 3.6.2.1.5.

602 High-voltage insulator loss of material due to mechanical wear caused by wind is not an aging effect requiring management, see 3.6.2.2.2.

603 High-voltage insulator reduced insulation resistance due to presence of salt deposits or surface contamination are not aging effects requiring management, see 3.6.2.2.2.

604 Switchyard bus and connection loss of material due to wind-induced abrasion or increased resistance of connection due to oxidation are not aging effects requiring management, see 3.6.2.2.3.

605 Transmission conductor loss of strength due to corrosion is not an aging effect requiring management, see 3.6.2.2.3.

606 Transmission connector increased resistance of connection due to oxidation or loss of pre-load are not aging effects requiring management, see 3.6.2.2.3.

607 Transmission conductor loss of material due to wind-induced abrasion is not an aging effect requiring management at PNPP, see 3.6.2.2.3.

4.0 TIME-LIMITED AGING ANALYSES AND EXEMPTIONS

The License Renewal Rule, 10 CFR 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants*, Section 54.1, governs the issuance of renewed operating licenses for nuclear power plants and includes requirements for the performance of an integrated plant assessment (IPA) and for the review of time-limited aging analyses (TLAAs). The results of the IPA and TLAA evaluations form the technical bases upon which the License Renewal Application (LRA) for Perry Nuclear Power Plant (PNPP), Unit 1, is built.

10 CFR 54.21(c) requires a list of TLAAs as part of the application for a renewed license. 10 CFR 54.21(c)(2) requires a list of current exemptions to 10 CFR 50 based on time-limited aging analyses as part of the application for a renewed license.

§54.21 Contents of application -- technical information.

(c) An evaluation of time-limited aging analyses.

1. *A list of time-limited aging analyses, as defined in §54.3, must be provided. The applicant shall demonstrate that -*
    - *(i) The analyses remain valid for the period of extended operation;*
    - *(ii) The analyses have been projected to the end of the period of extended operation; or*
    - *(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.*
2. *A list must be provided of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based on time-limited aging analyses as defined in §54.3. The applicant shall provide an evaluation that justifies the continuation of these exemptions for the period of extended operation.*

This section describes the TLAAs and Exemptions applicable to PNPP in accordance with 10 CFR 54.

4.1 TIME-LIMITED AGING ANALYSES

Pursuant to 10 CFR 54.3, time-limited aging analyses (TLAAs) are those licensee calculations and analyses that:

(1) Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a);

(2) Consider the effects of aging;

(3) Involve time-limited assumptions defined by the current operating term, for example, 40 years;

(4) Were determined by the licensee to be relevant in making a safety determination.

(5) Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended function(s), as delineated in (10 CFR) 54.4(b); and,

(6) Are contained or incorporated by reference in the current licensing basis (CLB).

4.1.1 IDENTIFICATION OF TLAAS

TLAAs have been identified for PNPP using methods consistent with those provided in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," (SRP) [Reference 4.7-20], and with 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." A list of potential generic TLAAs was assembled from the SRP, industry guidance, and experience, including:

- NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," [Reference 4.7-20];

- NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," [Reference 4.7-22];

- NEI 95-10, Revision 6, "Industry Guideline for Implementing the Requirements of 10 CFR 54, the License Renewal Rule; [Reference 4.7-37]

- The 10 CFR 54 Final Rule, "Statement of Considerations," and,

- Prior License Renewal Applications, NRC Requests for Additional Information and NRC Safety Evaluation Reports for these applications.

CLB and design basis documentation was searched to identify potential TLAAs. The document search included the following:

- Updated Final Safety Analysis Report (UFSAR);

- Facility Operating License;
- EPRI BWRVIP documents (incorporated by reference in the CLB);
- NRC Safety Evaluation Reports (SERs); and,
- 10 CFR 50.12 Exemption Requests.

Each potential TLAA was reviewed against the six 10 CFR 54.3(a) criteria. Those that met all six criteria were identified as TLAAs that require evaluation for the period of extended operation.

Table 4.1-1 (below) lists the example TLAAs provided in NUREG-1800, Tables 4.1-2 and 4.1-3, and specifies whether the TLAA is applicable for PNPP. The TLAAs with a “Yes" entry apply for PNPP and the LRA section where they are evaluated is provided. The TLAAs with a "No" entry do not apply for PNPP, either because they are associated with design features not employed at PNPP or no analysis was identified that met all six TLAA criteria.

Table 4.1-1
TLAA Comparison to NUREG-1800 Tables 4.1-2 & 4.1-3

TLAA Description	Applicable to PNPP	LRA Section
NUREG-1800 Table 4.1-2 Generic TLAAs		
Reactor vessel neutron embrittlement analyses	Yes	4.2
Metal Fatigue	Yes	4.3
Environmental qualification of electrical equipment	Yes	4.4
Concrete containment tendon prestress	No (PNPP containment design does not include tendons.)	N/A
Inservice local metal containment corrosion analyses	No (No TLAA Identified)	N/A
NUREG-1800 Table 4.1-3 Examples of Potential Plant-Specific TLAAs		
Intergranular separation in the heat-affected zone (HAZ) of reactor vessel low-alloy steel under austenitic SS cladding	No (RPV materials are melted to a fine grain practice)	N/A

Table 4.1-1
TLAA Comparison to NUREG-1800 Tables 4.1-2 & 4.1-3

TLAA Description	Applicable to PNPP	LRA Section
Low-temperature overpressure protection (LTOP) analyses	No (No TLAA identified.)	N/A
Fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater pumps	No (PNPP is a BWR that does not have an AFW Pump.)	N/A
Fatigue analysis of the reactor coolant pump flywheel	No (PNPP is a BWR and the reactor recirculation pumps do not have flywheels)	N/A
Fatigue analysis of polar crane	Yes	4.6.1
Flow-induced vibration endurance limit for the reactor vessel internals	No (No TLAA Identified)	N/A
Transient cycle count assumptions for the reactor vessel internals	Yes	4.3
Ductility reduction of fracture toughness for the reactor vessel internals	Yes	4.6.3
Leak before break	No (PNPP does not credit leak before break)	N/A
Fatigue analysis for the containment liner plate	No (PNPP design consists of a free-standing containment vessel; see LRA Section 4.5)	N/A
Containment penetration pressurization cycles	Yes	4.5
Metal corrosion allowance	No (No TLAA Identified)	N/A
High-energy line-break postulation based on fatigue cumulative usage factor	Yes	4.3.5

Table 4.1-1

TLAA Comparison to NUREG-1800 Tables 4.1-2 & 4.1-3

TLAA Description	Applicable to PNPP	LRA Section
Inservice flaw growth analyses that demonstrate structure stability for 40 years	No (No TLAA Identified)	N/A

4.1.2 EVALUATION OF PNPP TIME-LIMITED AGING ANALYSES

Each PNPP TLAA evaluation contains the following information:

TLAA Description: A description of the CLB analysis that has been identified as a TLAA, including a description of the aging effect evaluated, the time-limited variable used in the analysis, and its basis.

TLAA Evaluation: An evaluation of the TLAA for the period of extended operation. This section provides information associated with 60 years of operation for comparison with the information used in the TLAA that considered 40 years of operation. This evaluation will demonstrate that the TLAA disposition will fall into one of the three disposition categories described in 10 CFR 54.21(c)(1):

(i) The analyses remain valid for the period of extended operation;
(ii) The analyses have been projected to the end of the period of extended operation;
(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Disposition: The disposition provides the classification in accordance with one of the acceptance criteria from 10 CFR 54.21(c)(1) listed above.

4.1.3 Summary of Results

LRA Table 4.1-2 (below) provides a summary of the results of the TLAA evaluations and includes a reference to the applicable LRA section where each TLAA evaluation is documented.

Table 4.1-2 - TLAA Results Summary

Subject	TLAA	Section	Disposition
Reactor Pressure Vessel Neutron Embrittlement	Neutron Fluence	4.2.1	TLAA projected to the end of the PEO per 10 CFR 54.21(c)(1)(ii).
	Upper Shelf Energy (USE)	4.2.2	TLAA projected to the end of the PEO per 10 CFR 54.21(c)(1)(ii).
	Adjusted Reference Temperature Analyses	4.2.3	TLAA projected to the end of the PEO per 10 CFR 54.21(c)(1)(ii).
	Pressure-Temperature (P-T) Limits	4.2.4	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	RPV Shell Weld Failure Probability Assessment Analyses	4.2.5	TLAA projected to the end of the PEO per 10 CFR 54.21(c)(1)(ii).
	RPV Reflood Thermal Shock	4.2.6	TLAA projected to the end of the PEO per 10 CFR 54.21(c)(1)(ii).
Metal Fatigue	Reactor Pressure Vessel	4.3.1.1	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Class 1 Piping	4.3.1.2	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Non-Class 1 Fatigue	4.3.2	TLAA will remain valid for the PEO per 10 CFR 54.21(c)(1)(i).
	Environmental Fatigue	4.3.3	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Reactor Vessel Internals Fatigue	4.3.4	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Intermediate HELB location Determination	4.3.5	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).

Table 4.1-2 - TLAA Results Summary			
Subject	**TLAA**	**Section**	**Disposition**
Environmental Qualification for Electrical Equipment	EQ Evaluations	4.4	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
Other Potential Plant-Specific TLAAs	Containment Vessel	4.5.1	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Containment Piping Penetrations	4.5.2	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Containment Piping Penetration Bellows	4.5.3	TLAA will remain valid for the PEO per 10 CFR 54.21(c)(1)(i).
	Crane Load Cycles	4.6.1	TLAA will remain valid for the PEO per 10 CFR 54.21(c)(1)(i).
	Main Steam Line Flow Restrictors Erosion Analysis	4.6.2	TLAA projected to the end of the PEO per 10 CFR 54.21(c)(1)(ii).
	Reduction of Fracture Toughness for the Reactor Vessel Internals	4.6.3	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Fatigue Analysis -- Earthquake Cyclic Loading	4.6.4	TLAA will remain valid for the PEO per 10 CFR 54.21(c)(1)(i).
	Fatigue due to Partial Feedwater Heating	4.6.5	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Fatigue due to Single Recirculation Loop Operation	4.6.6	TLAA projected to the end of the PEO per 10 CFR 54.21(c)(1)(ii).e
	Steam Piping Erosion	4.6.7	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Silicone Sealant in ESF HVAC	4.6.8	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Top Guide Grid Beam Neutron Fluence	4.6.9	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).
	Jet Pump Fatigue Analysis	4.6.10	TLAA will be managed per 10 CFR 54.21(c)(1)(iii).

Table 4.1-2 - TLAA Results Summary

Subject	TLAA	Section	Disposition
	Allowable Stress Analysis of BOP ASME Code Class 1, 2 and 3 Components	4.6.11	TLAA will remain valid for the PEO per 10 CFR 54.21(c)(1)(i).
	RV Annealing	4.6.12	TLAA will remain valid for the PEO per 10 CFR 54.21(c)(1)(i).

4.1.4 Identification Of Exemptions Pursuant To 10 CFR 50.12

The exemptions for PNPP were identified through a search of the CLB and design basis documentation identified in LRA Section 4.1.1. Exemptions currently in effect for PNPP pursuant to 10 CFR 50.12 were reviewed and it was determined that none were associated with or supported by TLAAs.

4.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT ANALYSES

10 CFR 50.60, [Reference 4.7-1] requires that all light-water reactors meet the fracture toughness and material surveillance program requirements for the reactor coolant pressure boundary as set forth in 10 CFR 50, Appendices G and H. The ferritic materials of the reactor pressure vessel are subject to embrittlement due to high energy (E > 1.0 MeV) neutron exposure. Embrittlement means the material has lower toughness (i.e., will absorb less strain energy during a crack or rupture), thus allowing a crack to propagate more easily under thermal and pressure loading. Neutron embrittlement analyses are used to account for the reduction in fracture toughness associated with the cumulative neutron fluence (total number of neutrons that intersect a square centimeter of component area during the life of the plant).

Toughness (indirectly measured in foot-pounds of absorbed energy in a Charpy impact test) is temperature dependent in ferritic materials. An initial nil-ductility reference temperature (RT_{NDT}) is associated with the transition from ductile to brittle behavior and is determined for vessel materials through a combination of Charpy and drop-weight testing. Toughness increases with temperature up to a maximum value called the *upper-shelf energy*, or USE. Neutron embrittlement results in a decrease in the USE of reactor pressure vessel steels. This means higher temperatures are required for the material to behave in a ductile manner than were required before embrittlement.

To reduce the potential for brittle fracture during reactor pressure vessel operation, changes in material toughness as a function of neutron radiation exposure (fluence) are accounted for using operating pressure-temperature (P-T) limits that are included in the PNPP Technical Specifications. The P-T limits account for the decrease in material toughness of the reactor pressure vessel beltline materials associated with a given fluence. The beltline region includes the reactor vessel materials that are predicted to receive a cumulative high energy neutron exposure of $\geq$1.0E+17 n/cm^2 during the licensed life of the plant. Since the cumulative neutron fluence will increase during the period of extended operation, a review is required to determine if any additional components will exceed the threshold value and require evaluation for neutron embrittlement.

The toughness for beltline materials is projected to drop due to exposure to the predicted fluence values. As a result, Upper Shelf Energy (USE) calculations are performed to determine if the components will continue to have adequate fracture toughness at the end of license to meet the required minimums. P-T limit curves are generated to provide minimum temperature limits that must be achieved during operations prior to application of specified reactor pressure vessel pressures. The P-T limit curves are based upon the RT_{NDT} and ΔRT_{NDT} (change in RT_{NDT}) values computed for the licensed operating period along with appropriate margins.

The reactor pressure vessel material ΔRT_{NDT} and USE values, calculated based on neutron fluence, are part of the licensing basis and support safety determinations. The increases in RT_{NDT} (ΔRT_{NDT}) also affect the bases for relief from circumferential weld inspection and the supporting calculation of limiting axial weld conditional failure probability. Therefore, these calculations constitute TLAAs.

The following TLAAs related to neutron embrittlement are evaluated in the LRA subsections listed below:

- Neutron Fluence (Section 4.2.1)
- Upper-Shelf Energy (Section 4.2.2)
- Adjusted Reference Temperature Analyses (Section 4.2.3)
- Pressure – Temperature Limits (Section 4.2.4)
- Reactor Pressure Vessel Shell Welds Failure Probability Assessment Analyses (Section 4.2.5)
- Reactor Pressure Vessel Reflood Thermal Shock (Section 4.2.6)

4.2.1 NEUTRON FLUENCE

TLAA Description:

Neutron fluence is the term used to represent the cumulative number of neutrons per square centimeter that contact the reactor vessel shell and its internal components over a given period. The fluence projections that quantify the number of neutrons that contact these surfaces have been used as inputs to the neutron embrittlement analyses that evaluate the loss of fracture toughness aging effect resulting from neutron fluence.

Fluence projections were performed to predict the neutron fluence expected to occur during 32 Effective Full Power Years (EFPY) of plant operation. The 32 EFPY fluence calculations were submitted in a letter dated June 4, 2002 [Reference 4.7-2] and approved by the NRC in a letter dated April 29, 2003 [Reference 4.7-3]. At the time the projections were prepared, 32 EFPY was considered to represent the amount of power to be generated over 40 years of plant operation, assuming a 40-year average capacity factor of 80 percent. These fluence projections constitute TLAAs requiring evaluation for the period of extended operation.

UFSAR Sections 4.3.2.8 and 5.3.1.6.2 provide evaluations of the effect of neutron fluence on reactor vessel materials. These evaluations constitute TLAAs. BWRVIP-74-A, *BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal*, [Reference 4.7-26], Section A.4.1, identified the evaluation of the loss of reactor vessel fracture toughness due to neutron fluence as a TLAA.

TLAA Evaluation:

EFPY projections:

End-of-life fluence is based on a projected value of EFPY over the licensed life of the plant. The full power operating license (FPOL) for PNPP Unit 1 was issued in November 1986. PNPP Unit 1 was originally licensed for a maximum thermal power of 3579 MWt.

License Amendment No. 112, issued June 1, 2000, increased the maximum thermal power to 3758 MWt through a 5% thermal power uprate. License Amendment No. 191, issued on October 8, 2020, revised the expiration date of PNPP's full power operating license (FPOL) such that it would expire 40 years from the date of issuance of the FPOL, as opposed to 40 years from the date of issuance of the fuel loading and low-power testing license. These changes to the Operating License are included in the fluence projections.

Operating cycle 18 was completed in the spring of 2021 with the accrued effective full power years (EFPY) of 27.3, representing approximately 35 years of operation. The projected EFPY though the end of the period of extended operation using a 96 percent average capacity factor (assumes 100 percent capacity factor between refueling outages and 30-day refueling outages every 2 years) is less than 54 EFPY at end of 60 years of operation.

Fluence projections:

The fluence values provided in this section were calculated using the Radiation Analysis Modeling Application (RAMA) Fluence Methodology. RAMA was developed for the Electric Power Research Institute and the Boiling Water Reactor Vessel and Internals Project. The NRC has reviewed and approved RAMA for BWR reactor pressure vessel (RPV) fluence predictions by letter dated February 7, 2008 [Reference 4.7-4]. Use of this methodology for evaluations of fluence for PNPP was performed in accordance with guidelines presented in NRC Regulatory Guide 1.190 [Reference 4.7-5]. In compliance with these guidelines, comparisons to surveillance capsule flux wire and dosimetry measurements were performed to determine the accuracy of the RPV fluence model. An uncertainty analysis was also performed to determine if a statistical bias exists in the model. It was determined that the PNPP model does not have a statistical bias and that the best-estimate fluence is suitable for use in evaluating the effects of embrittlement on RPV material as specified in 10 CFR 50 Appendix G [Reference 4.7-6] and NRC Regulatory Guide 1.99, Revision 2 [Reference 4.7-7].

Fast neutron fluence evaluation was performed for the RPV based on operating data through cycle 14. Fluence was calculated at EOC 14 (20.0 EFPY) and projected to 54 EFPY. In LRA Table 4.2-1, *PNPP RPV Beltline Fluence Data for 54 EFPY*, fast neutron fluence for energy >1.0 MeV is reported for the RPV plates, welds and nozzles throughout the RPV beltline region at the interface of the base metal and cladding, hereafter denoted as the 0t location of the RPV wall. Fluence attenuations are performed through the RPV wall to the ¼t locations using the displacement per atom (DPA) attenuation method prescribed in NRC Regulatory Guide 1.99, Revision 2. Fluence values that exceed the threshold value of 1.0E+17 n/cm2 for 54 EFPY define the RPV beltline for the period of extended operation. The maximum fluence value is 4.79E+18 n/cm2 for the lower-intermediate shell plate at the 0t location.

Neutron fluence analyses valid for 54 EFPY have been prepared for the reactor vessel beltline materials and bound the projected EFPY value for 60-years of operation.

Therefore, the neutron fluence analysis has been projected to the end of the period of extended operation.

Disposition:	10 CFR 54.21(c)(1)(ii)	The neutron fluence analysis has been projected to the end of the period of extended operation.

Table 4.2-1
PNPP RPV Beltline Fluence Data for 54 EFPY

Location	Nominal Wall Thickness (in.) Full	1/4t	Fluence @ 0t (n/cm^2)	Fluence @ 1/4t (n/cm^2)	Fluence Factor, FF $f^{(0.28-0.10 \log f)}$ @ 1/4t
Upper-Intermediate Shell Plate 23-1-1, 23-1-2, 23-1-3	6.00	1.500	2.14E+17	1.68E+17	0.154
Lower-Intermediate Shell Plate 22-1-1, 22-1-2, 22-1-3	6.00	1.500	4.79E+18	3.33E+18	0.697
Lower Shell Plate 21-1-1, 21-1-2, 21-1-3	6.75	1.688	4.85E+17	3.35E+17	0.234
Upper Intermediate Shell Weld BG, BJ, BK	6.00	1.500	2.07E+17	1.61E+17	0.150
Lower Intermediate Shell Weld BD, BF	6.00	1.500	3.31E+18	2.34E+18	0.608
Lower Intermediate Shell Weld BE	6.00	1.500	4.68E+18	3.28E+18	0.693
Lower Shell Weld BA, BB, BC	6.75	1.688	4.71E+17	3.32E+17	0.233
Upper Int./Lower Int. Shell Girth Weld AC	6.00	1.500	2.14E+17	1.68E+17	0.154
Lower Int./Lower Shell Girth Weld AB	6.00	1.500	4.85E+17	3.55E+17	0.242
Nozzle Weld N12	6.00	1.500	1.09E+18	7.17E+17	N/A

4.2.2 UPPER SHELF ENERGY

TLAA Description:

The current licensing basis Charpy upper shelf energy (USE) calculations were prepared for the PNPP reactor vessel beltline materials for 32 EFPY [Reference 4.7-2]. The PNPP UFSAR documents the minimum 32 EFPY Charpy-V-Notch test upper shelf energy for all reactor pressure vessel beltline materials. Since the USE value is a function of 32 EFPY fluence, associated with the 40-year licensed operating period, these USE calculations meet the criteria of 10 CFR 54.3(a) and constitute TLAAs requiring evaluation for 60 years.

BWRVIP-74-A, *BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal* [Reference 4.7-26], identified the evaluation of the USE calculations as a TLAA.

TLAA Evaluation:

USE is the standard industry parameter used to indicate the maximum toughness of a material at high temperature. 10 CFR 50 Appendix G [Reference 4.7-6] requires the predicted end-of-license USE for RPV materials to be at least 50 ft-lb (absorbed energy), unless an approved analysis supports a lower value. The predicted USE drop is determined in accordance with NRC Regulatory Guide 1.99, Revision 2, Section 2.2 [Reference 4.7-7].

Certified Material Test Report (CMTR) data were used to determine the initial USE values for the RPV beltline and extended beltline materials.

NRC Regulatory Guide 1.99, Revision 2, defines the method for predicting USE drop in terms of a percentage from the unirradiated value. Figure 2 of the Regulatory Guide provides percent decrease in the USE as a function of ¼t fluence and the copper content for plates and welds. The ¼t fluence at 54 EFPY is used to determine the reduction of the initial USE.

The 54 EFPY calculated USE values for the reactor vessel beltline materials are provided in LRA Table 4.2-2, *PNPP RPV Beltline USE Data for 54 EFPY*. The USE values for the beltline and extended beltline materials are projected to remain above the 50 ft-lb minimum requirement through the period of extended operation. Therefore, the USE analyses have been projected to the end of the period of extended operation.

Disposition:	10 CFR 54.21(c)(1)(ii)	The USE analyses have been projected to the end of the period of extended operation.

Table 4.2-2
PNPP RPV Beltline USE Data for 54 EFPY

Description	Code No.	Heat No.	Cu (wt. %)	Initial USE (ft-lb)	Fluence @ 1/4t (n/cm^2)	Decrease %	54 EFPY USE (ft-lb)
Upper-Intermediate Shell Plate	23-1-3	C2432-1	0.05	61	1.68E+17	7.2	56
Upper-Intermediate Shell Plate	23-1-2	C2432-2	0.08	57	1.68E+17	7.2	52
Upper-Intermediate Shell Plate	23-1-1	C2453-1	0.08	75	1.68E+17	7.2	69
Lower-Intermediate Shell Plate	22-1-1	C2557-1	0.05	84	3.33E+18	14.6	71
Lower-Intermediate Shell Plate	22-1-3	A1155-1	0.06	114	3.33E+18	14.6	97
Lower-Intermediate Shell Plate	22-1-2	B6270-1	0.06	94	3.33E+18	14.6	80
Lower Shell Plate	21-1-1	C2448-1	0.06	61	3.35E+17	8.5	55
Lower Shell Plate	21-1-2	C2448-2	0.06	59	3.35E+17	8.5	53
Lower Shell Plate	21-1-3	A1068-1	0.08	56	3.35E+17	8.5	51
Upper-Intermediate Shell Axial Weld	BG, BJ, BK	5P6214B	0.027	88	1.61E+17	7.1	81
Lower Intermediate Shell Axial Weld	BD, BF	5P6214B	0.027	88	2.34E+18	13.4	76
Lower Intermediate Shell Axial Weld	BD, BF	627260	0.06	104	2.34E+18	14.3	89
Lower Intermediate Shell Axial Weld	BD, BF	626677	0.01	90	2.34E+18	13.4	77
Lower Intermediate Shell Axial Weld	BE	5P6214B	0.027	88	3.28E+18	14.6	75
Lower Intermediate Shell Axial Weld	BE	626677	0.01	90	3.28E+18	14.6	76

Description	Code No.	Heat No.	Cu (wt. %)	Initial USE (ft-lb)	Fluence @ 1/4t (n/cm^2)	Decrease %	54 EFPY USE (ft-lb)
Lower Intermediate Shell Axial Weld	BE	624063	0.03	105	3.28E+18	14.6	89
Lower Intermediate Shell Axial Weld	BE	627069	0.01	112	3.28E+18	14.6	95
Lower Shell Axial Weld	BA, BB, BC	5P6214B	0.027	88	3.32E+17	8.5	80
Upper Int./Lower Int. Shell Girth Weld	AC	492L4871	0.03	126	1.68E+17	7.2	116
Upper Int./Lower Int. Shell Girth Weld	AC	04T931	0.03	148	1.68E+17	7.2	137
Upper Int./Lower Int. Shell Girth Weld	AC	412L4711	0.02	163	1.68E+17	7.2	151
Upper Int./Lower Int. Shell Girth Weld	AC	05T776	0.06	103	1.68E+17	7.7	95
Lower Int./Lower Shell Girth Weld	AB	4P7216 (single wire)	0.03	82	3.55E+17	8.6	74
Lower Int./Lower Shell Girth Weld	AB	4P7216 (tandem wire)	0.03	82	3.55E+17	8.6	74

4.2.3 ADJUSTED REFERENCE TEMPERATURE ANALYSES

TLAA Description:

The adjusted reference temperature (ART) of the limiting beltline material is used to adjust the beltline P-T limit curves to account for irradiation effects. NRC Regulatory Guide 1.99, Revision 2 [Reference 4.7-7], provides the methodology for determining the ART of the limiting material. The ART is defined as the sum of the initial (unirradiated) reference temperature (Initial RT_{NDT}), the mean value of the adjustment in reference temperature caused by irradiation (ΔRT_{NDT}), and a margin (M) term.

10 CFR 50, Appendix G, defines the fracture toughness requirements for the life of the vessel. The shift in the initial RT_{NDT} (ΔRT_{NDT}) is evaluated as the difference in the 30 ft-lb index temperatures from the average Charpy curves measured before and after irradiation. This increase (ΔRT_{NDT}) determines how much higher the vessel temperature must be raised for the material to continue to act in a ductile manner. The ART is defined as: Initial RT_{NDT} + ΔRT_{NDT} + Margin.

Since the ΔRT_{NDT} value is a function of 32 EFPY fluence in the current ART calculations associated with the 40-year licensed operating period, these ART evaluations are TLAAs requiring evaluation for 60 years.

TLAA Evaluation:

10 CFR 50, Appendix G, requires the determination of ART values for reactor vessel beltline ferritic materials for the life of the plant. The beltline plates, axial welds, and circumferential welds are fabricated from ferritic materials. The beltline also includes the N6 low pressure coolant injection (LPCI) nozzles and welds and the N12 water level instrument (WLI) nozzles and welds. The ART values at the ¼t location for all 60-year beltline materials are provided in Table 4.2-3, PNPP Beltline RPV Material ART Data for 54 EFPY.

The LPCI N6 nozzles do not exceed the threshold of 1.0E+17 n/cm^2 prior to 54 EFPY. The WLI N12 nozzles exceed the threshold and are in the beltline. Since the N12 nozzles insert material is stainless steel and the N12 nozzles welds are Inconel (i.e., non-ferritic materials), they are not required to be included in the present ART analysis. Therefore, no nozzles or nozzle welds need to be evaluated in the present ART analysis. However, the geometric discontinuity caused by the N12 nozzle penetrations in the adjacent shells must be addressed for subsequent P-T curve evaluations.

When surveillance data exists from specimens that are from a matching heat number of the vessel beltline material being evaluated, a separate procedure is used to evaluate the ART. This procedure first determines the credibility of the data. If the surveillance data are credible, then a fitted chemistry factor (CF) is calculated using best estimate chemistry values. If the fitted CF results in a larger ART than would be obtained using Tables 1 and 2 of NRC Regulatory Guide 1.99 then the fitted CF must be used; otherwise, either the fitted CF or a CF obtained from NRC Regulatory Guide 1.99, Tables 1 or 2 may be used. If the surveillance data are credible and the fitted CF is used in the ART calculation, then the margin term σ_Δ, as specified by NRC Regulatory Guide 1.99, may be cut in half. That is, σ_Δ becomes 28°F/2 = 14°F for welds and 17°F/2 = 8.5°F for base metals. This procedure was applicable to the plate heat C2557-1 and weld heat 5P6214B, as both materials are included in the Integrated Surveillance Program (ISP) and are also included in the beltline. For the plate C2557-1 and weld 5P6214B, the fitted CF based on ISP data is calculated and compared to the CF obtained from NRC Regulatory Guide 1.99, Tables 1 or 2. The calculated ART for Heat No. C2557-1 and 5P6214B are based on surveillance data.

Disposition: 10 CFR 54.21(c)(1)(ii) The ART analyses have been projected to the end of the period of extended operation.

Table 4.2-3

PNPP Beltline RPV Material ART Data for 54 EFPY

Description	Code No.	Heat No.	Initial RT_{NDT} (°F)	Chemistry		Chemistry Factor (°F)	Adjustments for 1/4t			
								Margin Terms		
				Cu (wt. %)	Ni (wt. %)		ΔRT_{NDT} (°F)	σ_i (˚F)	σ_Δ (˚F)	ART (°F)
Upper-Intermediate Shell Plate	23-1-3	C2432-1	0	0.05	0.61	31	4.8	0.0	2.4	9.6
Upper-Intermediate Shell Plate	23-1-2	C2432-2	10	0.08	0.61	51	7.9	0.0	3.9	25.7
Upper-Intermediate Shell Plate	23-1-1	C2453-1	0	0.08	0.63	51	7.9	0.0	3.9	15.7
Lower-Intermediate Shell Plate	22-1-1	C2557-1	10	0.05	0.63	36.43	25.4	0.0	8.5	52.4
Lower-Intermediate Shell Plate	22-1-3	A1155-1	-10	0.06	0.63	37	25.8	0.0	12.9	41.6
Lower-Intermediate Shell Plate	22-1-2	B6270-1	-30	0.06	0.63	37	25.8	0.0	12.9	21.6
Lower Shell Plate	21-1-1	C2448-1	10	0.06	0.65	37	8.7	0.0	4.3	27.3
Lower Shell Plate	21-1-2	C2448-2	10	0.06	0.65	37	8.7	0.0	4.3	27.3
Lower Shell Plate	21-1-3	A1068-1	10	0.08	0.67	51	11.9	0.0	6.0	33.9

Description	Code No.	Heat No.	Initial RT_{NDT} (°F)	Chemistry		Chemistry Factor (°F)	Adjustments for 1/4t			
				Cu (wt. %)	Ni (wt. %)		ΔRT_{NDT} (°F)	Margin Terms		ART (°F)
								α_i (°F)	α_Δ (°F)	
Upper-Intermediate Shell Axial Weld	BG, BJ, BK	5P6214B	-40	0.03	0.94	43.28	6.5	0.0	3.2	-27.0
Lower Intermediate Shell Axial Weld	BD, BF	5P6214B	-40	0.03	0.94	43.28	26.3	0.0	13.1	12.6
Lower Intermediate Shell Axial Weld	BD, BF	627260	-30	0.06	1.08	82	49.8	0.0	24.9	69.6
Lower Intermediate Shell Axial Weld	BD, BF	626677	-20	0.01	0.85	20	12.2	0.0	6.1	4.3
Lower Intermediate Shell Axial Weld	BE	5P6214B	-40	0.027	0.94	43.28	30.0	0.0	14.0	18.0
Lower Intermediate Shell Axial Weld	BE	626677	-20	0.01	0.85	20	13.9	0.0	6.9	7.7
Lower Intermediate Shell Axial Weld	BE	624063	-50	0.03	1.00	41	28.4	0.0	14.2	6.9
Lower Intermediate Shell Axial Weld	BE	627069	-60	0.01	0.94	20	13.9	0.0	6.9	-32.3
Lower Shell Axial Weld	BA, BB, BC	5P6214B	-40	0.03	0.94	43.28	10.1	0.0	5.0	-19.8
Upper Int./Lower Int. Shell Girth Weld	AC	492L4871	-50	0.03	0.98	41	6.3	0.0	3.2	-37.4

Description	Code No.	Heat No.	Initial RT_{NDT} (°F)	Chemistry		Chemistry Factor (°F)	Adjustments for 1/4t			
							ΔRT_{NDT} (°F)	Margin Terms		ART (°F)
				Cu (wt. %)	Ni (wt. %)			α_i (˚F)	α_Δ (˚F)	
Upper Int./Lower Int. Shell Girth Weld	AC	04T931	-60	0.03	1.00	41	6.3	0.0	3.2	-47.4
Upper Int./Lower Int. Shell Girth Weld	AC	412L4711	-60	0.02	0.91	27	4.2	0.0	2.1	-51.7
Upper Int./Lower Int. Shell Girth Weld	AC	05T776	-70	0.06	0.92	82	12.6	0.0	6.3	-44.7
Lower Int./Lower Shell Girth Weld	AB	4P7216 (single wire)	-20	0.03	0.79	41	9.9	0.0	5.0	-0.2
Lower Int./Lower Shell Girth Weld	AB	4P7216 (tandem wire)	-20	0.03	0.81	41	9.9	0.0	5.0	-0.2

4.2.4 PRESSURE TEMPERATURE (P-T) LIMITS

TLAA Description:

10 CFR 50 Appendix G [Reference 4.7-6] requires that the reactor pressure vessel be maintained within established pressure-temperature (P-T) limits, including heat-up and cooldown operations. These limits specify the maximum allowable pressure as a function of reactor coolant temperature. As the reactor pressure vessel is exposed to increased neutron irradiation, its fracture toughness is reduced. The P-T limits must account for the anticipated reactor vessel fluence. The current PNPP P-T limits are valid to 32 Effective Full Power Years (EFPY) of operation. Since the P-T limits are a function of 32 EFPY fluence, associated with the 40-year licensed operating period, these P-T limits meet the criteria of 10 CFR 54.3(a) and have been identified as TLAAs requiring evaluation for 60 years.

TLAA Evaluation:

By letter dated June 23, 2014, FENOC requested an amendment (Amendment No. 168) to the PNPP Technical Specification 3.4.11, *RCS Pressure and Temperature (P/T) Limits* [Reference 4.7-8]. The proposed amendment revised the P-T limit curves to address two issues. First, it was determined that an existing water level instrument nozzle (WLIN) in the reactor pressure vessel (RPV) beltline region was not included in the data used to develop the PNPP P-T curves. Second, it was determined that the reactor coolant system (RCS) experiences a vacuum under certain conditions. The TS 3.4.11 figures reflect gauge pressure, did not include a vacuum region, and did not depict P-T limit curves that extend into the vacuum region. In the safety evaluation for Amendment No. 168 dated June 12, 2015 [Reference 4.7-27], the NRC concluded the P-T limits were developed appropriately using approved methodologies, and the proposed P-T limits valid for 32 EFPYs satisfied the requirements of Appendix G to Section XI of the ASME Code and Appendix G to 10 CFR Part 50.

The PNPP Technical Specifications have been revised since the P-T limits were approved in Amendment No. 168. The current Technical Specifications were issued in Amendment No. 187 date 2/17/2023 [Reference 4.7-3]. However, the P-T limits approved in Amendment No. 168 are still valid.

The P-T limits are located in the Technical Specifications and are required to be updated through the 10 CFR 50.90 licensing process separate from this license renewal process.

Disposition:	10 CFR 54.21(c)(1)(iii)	The P-T limits will be managed, as part of the 10 CFR 50.90 licensing process, for the period of extended operation.

4.2.5 RPV Shell Welds Failure Probability Assessment Analyses

TLAA Description:

An evaluation of the current inspection requirements for Boiling Water Reactor (BWR) pressure vessel beltline shell welds was performed and documented in BWRVIP-05 [Reference 4.7-9] and BWRVIP-74-A [Reference 4.7-26]. These reports include evaluations to determine the probability of failure (POF) of the reactor pressure vessel (RPV) beltline axial and circumferential welds. In the reports and including the associated NRC safety evaluations [References 4.7-10 and 4.7-11], it is shown that the POF from the circumferential welds is significantly lower than that for the axial welds. As a result of these evaluations, FENOC requested, and the NRC approved, a relief request to permanently defer the volumetric inspections of the circumferential welds in the PNPP RPV.

The POF is dependent upon given assumptions of flaw density, distribution, and location. The PNPP RPV is a Chicago Bridge and Iron (CB&I) fabricated vessel. Since the current shell weld failure probability analyses for the CB&I vessels are based upon 32 EFPY fluence values associated with 40 years of operation, they constitute TLAAs requiring evaluation for 54 EFPY through the period of extended operation.

TLAA Evaluation:

BWRVIP-329-A evaluated the application of latest computer techniques to identify the limiting combinations of RT_{MAX} for plates and axial and circumferential welds that ensure total through-wall cracking frequency remains ≤ 1E-6 yr-1 for the RPV beltline and ≤ 1E-7 yr-1 for the circumferential welds during a postulated, low temperature isothermal pressure transient in BWR RPVs [Reference 4.7-38]. The BWRVIP defined the envelope of RPV dimensions that are enveloped by the probabilistic fracture mechanics evaluation and provided a template to demonstrate that end-of-interval RT_{MAX} values are within the envelope of limiting RT_{MAX} values for which the safety goals remain satisfied. The NRC SER for BWRVIP-329-A determined that that the BWRVIP analyses were acceptable for referencing to satisfy the defined safety goals during extended plant operations. [Reference 4.7-38]

PNPP has evaluated the applicable reactor vessel parameters against the requirements of BWRVIP-329-A. Table 4.2-4 confirms that PNPP reactor vessel dimensions are within the limits of the enveloping RPV dimensions in BWRVIP-329-A.

Table 4.2-4

RPV PNPP Dimensions

Dimension	PNPP RPV Dimension	
Reactor Vessel Inside Radius to Cladding Base Metal Interface, [in.]	119 (min)	120.1875 (max)
Base Metal Wall Thickness, [in.]	6.00 (min)	7.125 (max)
Radius / Thickness	16.7 (min, calculated)	20.0 (max, calculated)
Cladding Thickness [in.]	0.1875 (nom)	

Table 4.2-5 provides the limiting maximum reference temperatures, RT_{MAX}, for ID surface values (i.e., 0T) and initial (unirradiated) reference temperature ($RT_{NDT(U)}$) for the PNPP RPV plates and welds based on 54-EFPY. The 54-EFPY RT_{MAX} values for the PNPP RPV plates and welds meet the acceptability criteria for limiting plate, circumferential weld, and axial weld in BWRVIP-329-A.

Table 4.2-5

PNPP RPV Material Adjusted Reference Temperature for 54-EFPY

Parameter	Limiting Plate	Limiting Circumferential Weld	Limiting Axial Weld
Component No.	Lower-Intermediate Shell Plate 22-1-3	Lower Int/Lower Shell Girth Weld AB	Lower Intermediate Shell Axial Weld BD, BF
Heat / Lot Identification Number	A1155-1	4P7216 (single wire) 4P7216 (tandem wire)	627260
Copper Content (wt. %)	0.06	0.03	0.06
Nickel Content (wt. %)	0.63	0.79 (single wire) 0.81 (tandem wire)	1.08
Chemistry Factor (CF) (°F)	37	41	82
54-EFPY EOI Neutron Fluence (f) (n/cm2)	4.79E18	4.85E17	3.31E18 (BD) 3.15E18 (BF)
RT_{NDT}(U) (°F)	-10	-20	-30
EOI ΔRT_{NDT} (°F)	29.4	11.8	57.1
EOI RT_{MAX} (°F)	48.8	3.6	83.1
EOI RT_{MAX} < Limiting RT_{MAX}?	Yes	Yes	Yes

The RPV shell welds failure probability assessment analyses have been projected to the end of the period of extended operation.

Disposition: 10 CFR 54.21(c)(1)(ii) The RPV shell welds failure probability assessment analyses have been projected to the end of the period of extended operation.

4.2.6 RPV Reflood Thermal Shock

TLAA Description:

10 CFR 50 Appendix A, General Design Criterion (GDC) 31, requires that the reactor coolant pressure boundary (RCPB) of a light water reactor (LWR) be designed such that it possesses adequate margin against non-ductile failure for all postulated conditions.

For General Electric (GE) designed Boiling Water Reactors (BWRs) this requirement has been demonstrated through development of Pressure-Temperature Limit Curves (P-T curves) and reference to generic analyses [References 4.7-14 and 4.7-15], which address the limiting Loss of Coolant Accident (LOCA) event. The acceptance criterion used in these analyses is that the crack driving force for postulated flaws in the reactor pressure vessel (RPV), K_I present during the bounding Emergency or Faulted condition (Service Level C and D), is less than the limiting material resistance to fracture, K_{IC}, applicable during the event. The analysis performed to address service level C/D conditions is often referred to as the RPV reflood thermal shock analysis.

Since the initial RPV reflood thermal shock analyses are based upon fluence values associated with 40 years of operation, they constitute TLAAs requiring evaluation for 54 EFPY through the period of extended operation.

TLAA Evaluation:

The updated PNPP RPV reflood thermal shock analysis considered plant operation through the period of extended operation (PEO) to demonstrate that adequate margin against non-ductile failure of the PNPP RPV exists as required by 10 CFR 50, Appendix A, GDC 31.

The generic analyses [References 4.7-14 and 4.7-15] only addressed this requirement for the RPV shell plates and welds since, at the time these analyses were prepared, the nozzles were not expected to receive enough irradiation during the life of the plant to require inclusion within the beltline. Due to increased capacity factors and power uprates, the N6 LPCI nozzles and N12 water level instrument nozzles have been added to the beltline and have been included in the updated evaluation to demonstrate adequate margin against non-ductile failure for all beltline materials during the PEO.

Beltline Shell Materials

The updated PNPP RPV reflood thermal shock analysis demonstrated that all beltline materials in the RPV will satisfy the acceptance criteria for postulated flaw sizes less than or equal to the flaws acceptable, without evaluation, in ASME Section XI IWB-3500 and considering operation through the end of the PEO. The beltline shell materials and beltline shells (plates and welds) were evaluated, with the main findings summarized below.

The limiting adjusted reference temperature (ART) at the RPV inside surface for beltline plates and welds at 54 EFPY is 83.1˚F, corresponding to weld heat number 627260 (lower intermediate shell axial weld BD, BF). The methodology for development of ART is addressed in Section 4.2.3. The limiting ART of 83.1˚F was used to establish fracture toughness allowables for the RPV reflood thermal shock analysis.

To ensure that the RPV can satisfactorily withstand the effects of the reflood thermal shock event following either a main steam line break LOCA or recirculation line break LOCA, it was demonstrated that a postulated flaw will remain stable and will not propagate throughout the event (i.e., crack driving force ($K_{I\ applied}$) is less than the allowable Mode I, plain strain, static initiation fracture toughness (K_{IC}/1.414)).

The results of the analysis for the main steam line break, which shows that the maximum $K_{Iapplied}$ for the beltline shells during a main steam line break LOCA is 105 ksi√in and is less than the allowable of 141 ksi√in (K_{IC}/1.414), are shown below in Table 4.2-6.

Table 4.2-6
Crack Stability Analysis for Beltline Shells during Main Steam Line Break

Minimum vessel temperature (˚F)	280
Limiting ART at 0T at 54 EFPY (˚F)	83.1
T-ART (˚F)	196.9
K_{Ic}/1.414 (ksi√in)	141
Maximum $K_{Iapplied}$ (ksi√in)	105
Margin	1.3

The results of the analysis for the recirculation line break, which shows that the $K_{Iapplied}$ for beltline shells during a recirculation line break LOCA is a maximum of 56 ksi√in at

480 seconds and is less than the allowable of 92 ksi√in (K_{IC}/1.414), are shown below in Table 4.2-7.

Table 4.2-7
Crack Stability Analysis for Beltline Shells during Recirculation Line Break

Time during transient (secs)	0	25	84	480	1200	3000
Temperature at 0.052t (˚F)	550	450	450	160	120	80
Limiting ART at 0t at 54 EFPY (˚F)	83.1	83.1	83.1	83.1	83.1	83.1
T-ART (˚F)	467	367	367	76.9	36.9	-3.1
K_{Ic}/1.414 (ksi√in)	141	141	141	92	54	37
$K_{Iapplied}$ at 0.052t (ksi√in)	33	47	20	56	47	24
Margin	4.2	3.0	7.0	1.6	1.1	1.5

Beltline Nozzles

The low pressure coolant injection (LPCI) N6 nozzles do not exceed the threshold of 1.0E+17 n/cm2 prior to 54 EFPY. The water level instrument nozzle (WLIN) N12 nozzles exceed the threshold and are in the beltline. These nozzles are not bounding for the present evaluation, both because of the thermal transient conditions and because there is no significant pressure load at the time of the maximum thermal stresses. Consequently, the geometric discontinuity caused by the penetrations does not contribute a localized intensification of the crack driving force.

The RPV reflood thermal shock analysis has been projected to the end of the period of extended operation.

Disposition: 10 CFR 54.21(c)(1)(ii) The RPV reflood thermal shock analysis has been projected to the end of the period of extended operation.

4.3 METAL FATIGUE

Fatigue analyses are TLAAs for Class 1 and non-Class 1 passive mechanical components. Fatigue is an age-related degradation mechanism caused by cyclic stressing of a component by either pressure/mechanical or thermal stresses.

NUREG-1801, Revision 2, provides a listing of components that are likely to have fatigue TLAAs within the current licensing basis that require evaluation for license renewal. Searches were performed to identify these and any other potential fatigue TLAAs within the CLB for PNPP. Each of the potential TLAAs were evaluated regarding the six TLAA screening criteria specified in 10 CFR 54.3. Those that were identified as TLAAs are evaluated in the following subsections:

- Class 1 Fatigue (Section 4.3.1)
- Non-Class 1 Fatigue (Section 4.3.2)
- Environmental Fatigue (Section 4.3.3)
- Reactor Vessel Internals Fatigue (Section 4.3.4)
- Intermediate High Energy Line Break (HELB) Location Determination (Section 4.3.5)

4.3.1 CLASS 1 FATIGUE

TLAA Description:

The PNPP reactor pressure vessel (RPV) and reactor coolant pressure boundary (RCPB) piping and components were designed in accordance with the ASME Code Section III, Class 1 design requirements. Fatigue analyses were prepared for these components to determine the effects of cyclic loadings resulting from changes in system temperature and pressure and for seismic loading cycles.

By letter dated September 9, 1999, FENOC requested a license amendment to increase the maximum thermal power to 3758 MWt through a 5% thermal power uprate. As part of this request, the effects of cyclic loading were re-evaluated. License Amendment No. 112, issued June 1, 2000, approved the power uprate.

Since the calculation of fatigue usage factors is part of the current licensing basis and is used to support safety determinations, and since the number of occurrences of each transient type was based upon 40-year assumptions, these Class 1 fatigue analyses constitute TLAAs requiring evaluation for the period of extended operation.

TLAA Evaluation:

The Fatigue Monitoring Program tracks and evaluates transient cycles, calculates cumulative usage factors (CUFs) and requires corrective action if design limits are approached. These activities are accomplished using cycle-based fatigue (CBF) monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0 (or 0.1 for high energy line break exclusion criteria), including environmental effects where applicable. Further details on the Fatigue Monitoring Program are provided in Appendix B.

Based on the number of cycles accrued to April 13, 2021, PNPP projected the number of accrued cycles expected at the end of 60 years of operation. Table 4.3-1 shows the projected values through the period of extended operation. Though there are several transients whose 60-year cycle projections exceed the design number of cycles, the number of design cycles originally considered in the fatigue analyses is not a design limit. The ASME Code limits the CUF to a value of less than or equal to 1.0 for acceptable fatigue design. The CUFs are calculated using the actual transient temperature and pressure data, which is often less than that assumed in the design transient definitions, and results in reduced calculated fatigue usage for the actual events. A CUF below a value of 1.0 provides assurance that no crack has been formed. The fatigue usage evaluation results for the applicable piping and components are provided in LRA Sections 4.3.1.1, 4.3.1.2, 4.3.3, 4.3.4, and 4.5.

PNPP manages fatigue by calculating CUFs for the limiting Class 1 components.

Disposition:	10 CFR 54.21(c)(1)(iii)	The effects of fatigue on the intended functions of components analyzed in accordance with ASME Class 1 requirements will be managed for the period of extended operation by the Fatigue Monitoring Program.

Table 4.3-1
60-Year Projected Cycles

Program Transient Number	Program Transient Description	Accrued Cycles To 4/13/21	60-Year Projected Cycles	Design Cycles
1.	Bolt-up	21	37	123
2.	Design Hydrostatic Test	28	47	40
3.	Startup	118	176	120
3A.	Startup - Normal	115	166	N/A
3B.	Startup - Alternate	3	10	N/A
4	Turbine Roll & Increase to Rated Power	110	168	120
4A.	Turbine Roll & Increase to Rated Power-Normal	110	167	N/A
4B.	Turbine Roll & Increase to Rated Power-Alternate	0	1	N/A
5.	Daily Reduction to 75% Power	522	685	10,400
6.	Weekly Reduction to 50% Power	249	436	2,000
7.	Rod Pattern Change (from a thermal cycle standpoint, same transient as and monitored with #5, above)	--	--	N/A
8.	Loss of Feedwater (FW) Heaters - Turbine Trip with 100% Steam Bypass	12	22	10
9.	Loss of FW Heaters -Partial FW Heater Bypass	121	159	70
10.	Scram - Turbine Generator Trip, FW On, Main Steam Isolation Valves (MSIVs) Open	7	13	40
11.	Scram - Other Scrams	71	87	140

Program Transient Number	Program Transient Description	Accrued Cycles To 4/13/21	60-Year Projected Cycles	Design Cycles
12A.	Rated Power Operation - Occurrence of the Operating Basis Earthquake (OBE)	1	2	10/50 (1)
12B.	Rated Power Operation - Occurrence of the Safe Shutdown Earthquake (SSE)	0	1	1
13.	Shutdown - Reduction to 0% Power	139	209	116
14.	Shutdown – Hot Standby	100	131	116
14A.	Shutdown - Hot Standby (Normal)	99	127	N/A
14B	Shutdown - Hot Standby (Alternate)	1	4	N/A
15.	Shutdown – Blowdown to Condenser	114	169	N/A
15A.	Shutdown – Blowdown to Condenser (Normal)	113	165	116
15B.	Shutdown – Blowdown to Condenser (Alternate)	1	4	N/A
16.	Shutdown - Vessel Flooding	115	170	N/A
16A.	Shutdown - Vessel Flooding (Normal)	112	160	116
16B.	Shutdown - Vessel Flooding (Alternate)	3	10	N/A
17.	Shutdown - Residual Heat Removal (RHR) System Cooling	120	183	116
18.	Un-bolt	20	36	123
19.	Refueling	18	33	N/A
20.	Scram- Composite Loss of FW Pumps, Loss of Aux. Power & Turbine Generator Trip without Bypass	10	20	20

Program Transient Number	Program Transient Description	Accrued Cycles To 4/13/21	60-Year Projected Cycles	Design Cycles
21.	Scram - Safety Relief Valve (SRV) Malfunction, RPV Blowdown with Turbine Bypass	1	2	8
22.	Scram - Reactor Overpressure with Delayed Scram, FW On, MSIVs Open	0	1	1
23.	Scram - Automatic Blowdown	0	1	1
24.	Improper Start of Cold Recirculation Loop	0	1	1
25.	Sudden Start of Pump in Cold Recirculation Loop	1	4	1
26.	Improper Startup with Reactor Drain Shut Off, Followed by Turbine Roll and Increase to Rated Power	0	1	1
27.	Loss of Coolant Accident (LOCA) - Pipe Rupture and Blowdown	0	1	1
28.	Turbine Stop Valve Closure	313	404	690
29.	SRV Actuation (Acoustic Wave)	1797	2208	5460
30.	Single Safety Relief Valve Actuation	599	736	1600
	Multiple Safety Relief Valve Actuation	6	10	220
31.	Suppression Pool Temperature in Excess of 150˚F but Less Than 185 F (Containment Vessel)	0	1	N/A
32.	High Pressure Core Spray (HPCS) Injection	45	61	70
32A.	HPCS During LOFP (First Injection)	8	16	N/A
32B.	HPCS During LOFP (Subsequent Injections)	26	31	N/A
32C	HPCS Not During LOFP	11	14	N/A

Program Transient Number	Program Transient Description	Accrued Cycles To 4/13/21	60-Year Projected Cycles	Design Cycles
33.	Reactor Core Isolation Cooling (RCIC) Injection Through the Head Spray Nozzle	83	114	N/A
34	RCIC Injection to the Main Steam Line during transient 20 or inadvertent RCIC Injections to the Main Steam Line during plant operation.	N/A	N/A	N/A
35A.	Residual Heat Removal (RHR) (Shutdown Cooling) Injection to the RPV through the Low Pressure Coolant Injection (LPCI) "A" Nozzle	0	1	N/A
35B.	RHR (Shutdown Cooling) Injection to the RPV through the LPCI "B" Nozzle	0	1	N/A
35C.	RHR (Shutdown Cooling) Injection to the RPV through the LPCI "C" Nozzle	0	1	N/A
36.	LPCI Injections to the RPV Through “A” Nozzle	0	1	N/A
	LPCI Injections to the RPV Through “B” Nozzle	0	1	N/A
	LPCI Injections to the RPV Through “C” Nozzle	0	1	N/A
37A.	Single Loop Operation (SLO) of the Recirculation System: Loop A Out of Service	3	10	N/A
37B.	SLO of the Recirculation System: Loop B Out of Service	1	4	N/A
38.	SLO of the Recirculation System when the operating loop is between 36,000 and 48,500 gpm	3	6	N/A
39	Inadvertent Low Pressure Cooling System (LPCS) Activation	0	1	N/A

Program Transient Number	Program Transient Description	Accrued Cycles To 4/13/21	60-Year Projected Cycles	Design Cycles
40	Reactor Water Cleanup (RWCU) Isolation at Power	36	59	N/A
41	Out of Spec Cooldown	17	21	N/A
42	Out of Spec Heatup	8	10	N/A
43	RHR/LPCI “B” Injection Valve Test During Normal Operation	16	29	N/A
44	RHR/LPCI “C” Injection Valve Test During Normal Operation	12	15	N/A
45	RCIC Injection Valve Testing	208	247	N/A

Table Note(s):

(1) Fifty (50) peak OBE cycles for NSSS piping. Ten (10) peak OBE cycles for other NSSS equipment and components

4.3.1.1 REACTOR PRESSURE VESSEL

TLAA Description:

The reactor pressure vessel (RPV) is described in UFSAR Section 5.3.3.1. The RPV is designed, fabricated, tested, inspected, and stamped in accordance with the ASME Code Section III, Class I requirements including the addenda in effect at the date of order placement, Winter 1972. As discussed in Section 4.3.1, fatigue analyses were prepared for the RPV and then updated as part of the thermal power uprate.

The RPV fatigue analyses constitute TLAAs requiring evaluation for the period of extended operation.

TLAA Evaluation:

Based on a review of the stress reports, the limiting components in the RPV Class 1 pressure boundary were selected for monitoring to bound or represent all other components. The fatigue usage factors from all known evaluations were consulted, including updated evaluations for plant modifications like snubber reduction and power uprate. Summary of fatigue results for the limiting RPV locations are provided in Table 4.3-2 – *RPV Fatigue Usage Summary*, below.

The Fatigue Monitoring Program calculates CUFs for the limiting locations and requires corrective actions if design limits are approached. This is accomplished using cycle-based fatigue (CBF) monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0.

The effects of fatigue on the RPV will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

Disposition:	10 CFR 54.21(c)(1)(iii)	The effects of fatigue on the RPV will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

LRA Table 4.3-2

RPV Fatigue Usage Summary

Location	Usage as of 4/13/21	Allowable Usage	60-Yr Projected Usage
CRD Penetration	0.199	1.0	0.239
Core Spray Nozzle	0.366	1.0	0.455
Feedwater Nozzle	0.216	1.0	0.304
RHR/LPCI Nozzle	0.232	1.0	0.286
Stabilizer Bracket	0.516	1.0	0.718
Steam Dryer Bracket	0.074	1.0	0.109
Steam Outlet Nozzle	0.430	1.0	0.622
Main Closure Studs	0.430	1.0	0.737
Support Skirt	0.148	1.0	0.183
Vibration Instrumentation Nozzle	0.418	1.0	0.608
Water Level Instrumentation Nozzle	0.373	1.0	0.553

4.3.1.2 CLASS 1 PIPING

TLAA Description:

The Class 1 piping systems were designed to the requirements of Section III of the ASME Boiler and Pressure Vessel Code. As a result, detailed fatigue analyses were performed for all the Class 1 portions of the piping systems.

ASME Section III Class 1 piping includes portions of the following systems:

- Reactor Vessel (reactor vessel drain line and control rod drive)
- Nuclear Boiler
- Reactor Recirculation
- Standby Liquid Control System
- Residual Heat Removal
- Low Pressure Core Spray System
- High Pressure Core Spray System
- Reactor Core Isolation Cooling
- Reactor Water Cleanup
- Feedwater

TLAA Evaluation:

Based on a review of the stress reports, the limiting components in the RPV Class 1 pressure boundary were selected for monitoring to bound or represent all other components. A summary of fatigue results for the Class 1 piping is provided in Table 4.3-3, *Piping Fatigue Usage Summary.*

The Fatigue Monitoring Program calculates cumulative usage factors (CUFs) for the limiting locations and requires corrective actions if design limits are approached. This is accomplished using cycle-based fatigue (CBF) monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0 (or 0.1 for high energy line break exclusion criteria).

The effects of fatigue on the Class 1 piping will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

Disposition:	10 CFR 54.21(c)(1)(iii)	The effects of fatigue on the Class 1 piping will be managed for the period of extended operation by the Fatigue Monitoring Program.

LRA Table 4.3-3

Piping Fatigue Usage Summary

Location	Usage as of 4/13/21	Allowable Usage	60-Yr Projected Usage
P-101 Lower Containment Penetration, 32 inch diameter	0.425	1.0	0.507
FW Piping Node 110	0.443	1.0	0.697
FW Piping Node 273	0.068	0.1	0.097
HPCS Piping Node 43-C-Center-C	0.052	0.1	0.089
LPCI A Piping Node 4-1-5-CBR	0.033	0.1	0.042
LPCI B Piping Node CJ49-I-J48-EL	0.041	0.1	0.055
LPCI C Piping Node A36-I-36-CBB	0.038	0.1	0.057
LPCS C Piping Node 42-C-Center-CV	0.035	0.1	0.047
Main Steam Line Drain Piping Node A54-J-F73-GFSW	0.055	0.1	0.079
Main Steam Piping Node 281	0.046	0.1	0.076
RCIC Steam Piping Node 27-I-60-CBR	0.032	0.1	0.044
RCIC Water Piping Node 45-J-1-TTJA	0.224	1.0	0.349
RCIC Water Piping Node 97-C-Center-EL	0.021	0.1	0.025
Recirculation/RHR Piping Node 500	0.045	0.1	0.065
RWCU Piping Node 1-I-1-TTJA	0.051	0.1	0.080

4.3.2 NON-CLASS 1 FATIGUE

TLAA Description:

Piping designed in accordance with ASME Section III, Class 2 or 3 or ANSI B31.1 Piping Code is not required to have an explicit analysis of cumulative fatigue usage, but cyclic loading is considered in a simplified manner in the design process. These codes first require prediction of the overall number of thermal and pressure cycles expected during the 40-year lifetime of these components. Then a stress range reduction factor is determined for the predicted number of cycles. If the total number of cycles is 7,000 or less, the stress range reduction factor of 1.0 is applied, which would not reduce the allowable stress value. For higher numbers of cycles, a stress range reduction factor of less than 1.0 is applied that limits the allowable stresses applied to the piping, which reduces the likelihood of failure due to cyclic loading. These evaluations are implicit fatigue analyses since they are based upon cycles anticipated for the life of the component, and therefore, constitute TLAAs requiring evaluation for the period of extended operation.

TLAA Evaluation:

Portions of some of the non-Class 1 systems, such as residual heat removal and high pressure core spray, were designed in accordance with ASME Section III, Class 2 or 3 or ANSI B31.1 requirements, but are attached to ASME Section III, Class 1 piping and are affected by the same thermal and pressure transients as the Class 1 systems. The 60-year projections for the transient types that affect these piping systems demonstrate that the total number of cycles through the period of extended operation are limited to well below 7000 cycles, as shown in Table 4.3-1, *60-Year Projected Cycles*. Therefore, the stress range reduction factors originally selected for the components within these systems remain applicable and these TLAAs will remain valid through the period of extended operation.

The remaining systems, listed below, designed in accordance with ASME Section III, Class 2 or 3 or ANSI B31.1 requirements, are affected by different thermal and pressure cycles related to their specific operations.

- Control and computer room humidification
- Reactor plant sampling
- Fire protection
- Auxiliary steam and drains
- Hydrogen chemistry system
- Post accident sampling

- Div. 1 & 2 standby diesel generator exhaust, intake and crankcase
- Emergency DG

An operational review was performed for each system to determine the number of cycles that have occurred in the past and to project the total number of cycles that will occur through the period of extended operation. This projection includes the cycles during unit pre-operational testing, plant operational cycles, and periodic surveillance test cycles, as applicable. For each of these systems, the review concluded that the total number of cycles, projected for 60 years, will not exceed 7,000 cycles.

The transient cycles for the non-Class 1 systems have been evaluated and indicate that 7,000 transient cycles will not be exceeded for 60 years of operation. Therefore, the non-class 1 piping stress analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Disposition:	10 CFR 54.21(c)(1)(i)	The non-Class 1 piping stress analyses remain valid for the period of extended operation.

4.3.3 Environmental Fatigue

TLAA Description:

NUREG-1800, Revision 2 [Reference 4.7-20], provides a recommendation for evaluating the effects of the reactor water environment on the fatigue life of ASME Section III Class 1 components that contact reactor coolant. One method acceptable to the staff for satisfying this recommendation is to assess the impact of the reactor coolant environment on a sample of critical components. These critical components should include those identified in NUREG/CR-6260 [Reference 4.7-21] that are applicable to the plant. Consideration should also be given to adding additional component locations if they are more limiting than those considered in NUREG/CR-6260.

TLAA Evaluation:

NUREG/CR-6260 identified the following component locations, which are directly relevant to PNPP, to be the most sensitive to environmental effects for newer vintage General Electric plants.

1. Reactor vessel shell and lower head;
2. Reactor vessel feedwater nozzle;
3. Reactor recirculation piping (including inlet and outlet nozzles);
4. Core spray line reactor vessel nozzle and associated Class 1 piping;
5. Residual heat removal nozzles and associated Class 1 piping; and,
6. Feedwater line Class 1 piping

Similar to the evaluation performed in NUREG/CR-6260, the locations of highest design cumulative usage factors (CUFs) were evaluated for the components listed above. In addition, consideration was given to the differing environmental fatigue correction factor (F_{en}) associated with different materials, since some locations are composed of multiple materials. This could result in a location with a lower design CUF having a higher resultant CUF once the F_{en} factor is applied. Therefore, multiple locations were evaluated for components with multiple material types.

In determining the F_{en} for the component materials, the overall percentage of time the plant will have operated within each water chemistry regime by the end of the period of extended operation was determined based upon a review of plant chemistry records.

The three chemistry regimes for PNPP are:

- No hydrogen water chemistry (No HWC);
- Hydrogen water chemistry with noble metal chemical application (HWC with NMCA), and
- Online noble chemistry (OLNC).

The results of the chemistry review are presented in Table 4.3-4, *Water Chemistry Operational Regimes Data*. From the effective percentage of time in the regime, bounding dissolved oxygen (DO) levels were determined and used as an input in determining F_{en} values for each material.

The cycle-based monitoring locations discussed in Sections 4.3.1.1, 4.3.1.2, and 4.3.4 were screened to eliminate locations where environmentally-assisted fatigue (EAF) is not applicable to the component material/environment combination or where the CUF values are very low. For those locations not eliminated by the EAF susceptibility and CUF screening, bounding values of F_{en} were calculated based upon the applicable formula provided in Appendix A of NUREG/CR-6909 [Reference 4.7-23] for the carbon and low alloy steel and the austenitic stainless steel materials. Location-specific DO levels and maximum temperatures were used in these F_{en} calculations.

Using the resulting location-specific bounding F_{en} values and bounding CUF values, the environmental fatigue was determined using the fatigue curves specified in NUREG/CR-6909, Tables A.1 and A.2. Section A.2.1 of NUREG/CR-6909, Revision 1 [Reference 4.7-24] allows for the use of the average temperature (i.e., average of the maximum temperature for the transient and the higher of the threshold temperature for the material under consideration and the minimum temperature for the transient) for simple transients in cases of constant strain rate and linear temperature response.

Section 4.2.6 of EPRI Report Number TR-1012017 [Reference 4.7-25] indicates that for load pairs that may be subject to dynamic loading, F_{en} = 1.0 for the dynamic portion of the strain for the load pair in question. This is based on the premise that the cycling due to dynamic loading occurs too quickly for environmental effects to be significant. Accordingly, transient pairs which have solely dynamic loading values or have rapid cycling strain amplitudes below the strain amplitude threshold will have no environmental fatigue multipliers applied (i.e., F_{en} = 1.0).

Based on the calculated environmental fatigue values, the locations requiring more detailed analysis or monitoring were identified. The results of the EAF calculations for these bounding locations are provided in Table 4.3-5, *Environmental Fatigue Evaluation Summary Results*.

The Fatigue Monitoring Program calculates CUFs for the limiting locations and requires corrective actions if design limits are approached. This is accomplished using cycle-based fatigue (CBF) monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0, including environmental effects where applicable.

Therefore, effects of environmental fatigue on the intended functions of the RCPB components will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

Disposition:	10 CFR 54.21(c)(1)(iii)	The effects of environmental fatigue on the intended functions of the RCPB components will be managed for the

period of extended operation by the Fatigue Monitoring Program.

Table 4.3-4
Water Chemistry Operational Regimes Data

Description	Operational Regimes		
	No HWC	HWC With NMCA	OLNC
Percent of Time in Regime	26.7%	10.0%	63.3%
Hydrogen Injection Concentration	0 ppb	25 ppb	25 ppb
HWC Availability	N/A	90%	90%
Effective % of Time in Regime	34.0%	9.0%	57.0%

LRA Table 4.3-5
Environmental Fatigue Evaluation Summary Results

System	Location	Material	60-Year U	Ave. F_{en}	60-Year U_{en}
RPV Region A	Steam dryer bracket	SS	0.110	4.5	0.495
RPV Region C	Support skirt/lower head	LAS	0.184	3.62	0.666
FW nozzle and piping	FW nozzle	SS	0.304	3.13	0.951
RHR/LPCI nozzle and piping	RHR/LPCI nozzle	SS	0.043	4.0	0.172
	RHR/LPCI nozzle	Ni-Cr-Fe	0.139	2.49	0.346
	RHR/LPCI nozzle	LAS	0.119	3.80	0.452
	RHR/LPCI nozzle	CS	0.013	4.61	0.060
	LPCI piping pt. 15A-J-32-TTJA	CS	0.091	3.26	0.297
	LPCI piping pt. 1-I-1-TTJA	CS	0.060	5.08	0.305
Core spray nozzles and piping	HPCS/LPCS nozzle	Ni-Cr-Fe	0.266	1.84	0.491
	HPCS/LPCS nozzle	LAS	0.045	3.44	0.155
	HPCS piping pt. 46-J-27-TTJA	CS	0.004	8.6	0.036
	HPCS/LPCS nozzle	CS	0.056	2.71	0.152
Recirc nozzles and piping (includes RHR suction piping)	Recirculation piping pt. 216	SS	0.187	4.64	0.867
	RI nozzle	SS	0.036	3.78	0.136
	RO nozzle	LAS	0.212	3.32	0.705
	RHR suction piping pt. 544	CS	0.094	7.31	0.687

4.3.4 REACTOR VESSEL INTERNALS FATIGUE

TLAA Description:

The reactor vessel internals consist of the core support structure and non-core support structure components. The core support structure components are designed in accordance with ASME Code, Section III, Subsection NG and includes the shroud, shroud support cylinder, core plate and hardware, grid (top guide) and hardware, control rod guide tube, control rod housing, orificed fuel support and peripheral fuel support. As a result, detailed fatigue analyses were performed for the core support structure components.

TLAA Evaluation:

The bounding CUF values for the core support structure components of the reactor vessel internals are provided in Table 4.3-6, *Reactor Vessel Internals Fatigue Usage - Limiting Locations*. All other core support structure components are considered bounded by the listed components. The fatigue analyses for the core support structure components of the reactor vessel internals are based upon the same set of design transients as those used in the fatigue analyses for the reactor pressure vessel provided in Table 4.3-1, *60-Year Projected Cycles.*

As provided in Section B.2.19, the Fatigue Monitoring Program will be augmented to include cycle-based fatigue (CBF) monitoring for the limiting locations of the reactor vessel internals (core support structure components). CBF monitoring consists of calculating fatigue usage from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0.

Additionally, the BWR Reactor Vessel Internals Program, which includes detection and sizing of cracks by inspection in accordance with industry guidance, provides verification that cracking is not occurring.

The effects of fatigue on the core support structure components will be managed for the period of extended operation by the Fatigue Monitoring Program and BWR Reactor Vessel Internals Program in accordance with 10 CFR 54.21(c)(1)(iii).

Disposition:	10 CFR 54.21(c)(1)(iii)	The effects of fatigue on the core support structure components will be managed for the period of extended operation by the Fatigue Monitoring Program and BWR Reactor Vessel Internals Program.

LRA Table 4.3-6

Reactor Vessel Internals Fatigue Usage – Limiting Locations

Location	Bounding CUF
Shroud/Shroud Support	
Shroud Flange at Top Guide Elevation	0.249
Shroud Flange at Core Plate Elevation	0.482
Shroud-to-Shroud Support Cylinder Junction (Weld)	0.397
Core Plate and Hardware	
Core Plate Studs and Nuts	0.291
Core Plate Rim to Perforated Plate Weld	0.376

4.3.5 INTERMEDIATE HELB LOCATION DETERMINATION

TLAA Description:

UFSAR Section 3.6.2.1.5 indicates that the determination of intermediate high energy line break (HELB) locations for Class 1 piping relied on an evaluation of cumulative usage factors (CUFs). As long as other stress criteria were also met, a break is not postulated at a location if the CUF is less than 0.1. Usage factors, as calculated in the design fatigue analyses, account for the design transients assumed for the original 40-year life of the plant. The analysis of cumulative usage factors used in the selection of postulated high energy line break locations constitutes a TLAA.

TLAA Evaluation:

The CUF values used in determining HELB break locations were from the Class 1 piping fatigue analyses previously described in Section 4.3.1.2. The limiting intermediate HELB locations are identified in Table 4.3-3 by an allowable CUF of 0.1.

The Fatigue Monitoring Program calculates cumulative usage factors (CUFs) for the limiting locations and requires corrective actions if design limits are approached. This is accomplished using cycle-based fatigue (CBF) monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting locations do not exceed the design limit of 0.1 for high energy line break exclusion criteria.

The effects of fatigue on the intermediate HELB locations will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

Disposition:	10 CFR 54.21(c)(1)(iii)	The effects of fatigue on the intermediate HELB locations will be managed for the period of extended operation by the Fatigue Monitoring Program.

4.4 ENVIRONMENTAL QUALIFICATION FOR ELECTRICAL EQUIPMENT

TLAA Description:

The PNPP Environmental Qualification (EQ) of Electrical Components Program manages component thermal, radiation, and cyclical aging using aging evaluations based on 10 CFR 50.49(f) [Reference 4.7-16] qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered time-limited aging analyses (TLAAs) for license renewal.

The PNPP UFSAR also identified specific components that are managed by the EQ program. UFSAR Section 3.9.3.2.1.3 addressed the environmental qualification of the ECCS pump Class 1E motors. UFSAR Section 3.9.3.2.3.1.2 addressed the environmental qualification of the Main Steam Safety/Relief Valves. The environmental qualification of both these components constitutes TLAAs. The evaluation and management of these components is addressed as part of the EQ Program.

TLAA Evaluation:

The PNPP EQ Program implements the requirements of 10 CFR 50.49, as further defined and clarified by NUREG-0588, Revision 1 [Reference 4.7-17] and Regulatory Guide 1.89, Revision 1 [Reference 4.7-18], and is an aging management program for license renewal under 10 CFR 54.21(c)(1)(iii). Reanalysis of an aging evaluation to extend the qualification of components under 10 CFR 50.49(e) is performed on a routine basis as part of the PNPP EQ of Electrical Components Program which is described in Appendix B of this application. Important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). A discussion of the EQ component re-analysis attributes is included in the description of the Environmental Qualification (EQ) of Electrical Components Program.

Continued implementation of the Environmental Qualification (EQ) of Electrical Components Program, which is described in Appendix B of this application, for the period of extended operation ensures that the requirements of 10 CFR 50.49 will continue to be met.

Disposition:	10 CFR 54.21(c)(1)(iii)	Environmental qualification of electrical equipment will be managed for the period of extended operation by the EQ of Electrical Components Program.

4.5 CONTAINMENT LINER PLATE, METAL CONTAINMENTS, AND PENETRATION FATIGUE ANALYSIS

4.5.1 CONTAINMENT VESSEL

TLAA Description:

The containment vessel is a pressure retaining structure composed of a free standing steel cylinder with an ellipsoidal dome, secured to a steel-lined, reinforced concrete foundation mat. The free-standing portion of the containment vessel is supported by and anchored into the foundation mat, and is designed, fabricated and erected in accordance with the requirements of ASME Code Section III for Class MC components. As a result, a detailed fatigue analysis was performed for the PNPP containment vessel, which is a TLAA.

TLAA Evaluation:

The fatigue analyses of the containment structure were evaluated to select the highest fatigue usage components for monitoring. These high fatigue usage components bound or represent all other components in the containment structure. The fatigue results for the limiting containment component is provided in Table 4.5-1, *Containment Fatigue Usage – Limiting Location*.

The limiting location is included in the Fatigue Monitoring Program. The program calculates cumulative usage factors (CUFs) and requires corrective actions if design limits are approached. This is accomplished using cycle-based fatigue (CBF) monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0.

The effects of fatigue on the containment vessel will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

Disposition:	10 CFR 54.21(c)(1)(iii)	The effects of fatigue on the containment vessel will be managed for the period of extended operation by the Fatigue Monitoring Program.

Table 4.5-1 Containment Fatigue Usage – Limiting Locations

Location	Fatigue Usage (CUF) as of 4/13/21	60-Yr Projected CUF
P-101 Lower Containment Penetration, 32 inch diameter	0.425	0.507

4.5.2 CONTAINMENT PIPING PENETRATIONS

TLAA Description:

The containment penetrations are designed in accordance with the requirements of Section III of the ASME Boiler and Pressure Vessel Code. As a result, detailed fatigue analyses were performed for the containment penetration assemblies, which are TLAAs.

TLAA Evaluation:

The fatigue analyses of the containment penetrations were evaluated to select the highest fatigue usage penetrations for monitoring. These high fatigue usage penetrations bound or represent all other containment penetrations. The fatigue results for the limiting containment penetrations are provided in Table 4.5-2, *Containment Penetration Fatigue Usage - Limiting Locations*.

The Fatigue Monitoring Program calculates cumulative usage factors (CUFs) for the limiting locations and requires corrective actions if design limits are approached. This is accomplished using cycle-based fatigue (CBF) monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting locations do not exceed the design limit of 1.0.

The effects of fatigue on the containment penetrations will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

Disposition: 10 CFR 54.21(c)(1)(iii) The effects of fatigue on the containment penetrations will be managed for the period of extended operation by the Fatigue Monitoring Program.

LRA Table 4.5-2

Containment Penetration Fatigue Usage – Limiting Locations

Penetration	CUF as of 4/13/21	Projected 60-Year CUF
P-121 (Feedwater Guard Pipe)	0.316	0.403
P-402 (RHR B Pipe)	0.608	0.727
P-421 (RHR A Guard Pipe)	0.285	0.358
P-424 (RWCU Pipe)	0.328	0.398

4.5.3 CONTAINMENT PIPING PENETRATIONS BELLOWS

TLAA Description:

Guard pipe assemblies associated with containment penetrations utilize bellows. The PNPP specification required these bellows to be analyzed for at least 500 cycles of normal operation plus one safe shutdown earthquake (SSE) cycle for 40 years of operation. Therefore, these fatigue analyses are identified as TLAAs requiring disposition for license renewal.

TLAA Evaluation:

The fatigue analyses for these bellows determined they were capable of handling the movement from more normal operation or faulted cycles than were specified. The bellows are qualified for more than the 60 year projected number of startups and shutdowns, and therefore, the bellows analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Disposition: 10 CFR 54.21(c)(1)(i) The bellows fatigue analyses will remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.6 PLANT-SPECIFIC TLAAS

4.6.1 CRANE LOAD CYCLES

TLAA Description:

The following PNPP cranes are credited in the response to NUREG-0612 "Control of Heavy Loads at Nuclear Power Plants" [Reference 4.7-39]:

- Reactor Building Crane (a.k.a., Containment Polar Crane)
- Fuel Handling Building Crane
- Emergency Service Water Pump House Crane

These cranes are designed to the requirements of Crane Manufacturers Association of America (CMAA) Specification 70 (1975) for Class A service [Reference 4.7-19]. Cranes designated Class A service level are designed for 20,000 to 100,000 cycles. This evaluation of cycles over the 40-year plant life is the basis of a safety determination and has been identified as a TLAA that requires evaluation for 60 years.

TLAA Evaluation:

Reactor Building Crane (a.k.a., Containment Polar Crane)

The Reactor Building crane is used extensively during refueling outages. A conservative estimate of the number of cycles for 60 years of operation is 2,000 cycles. The rate of occurrence is based on refueling outages and the final core off load at the end of 60 years of operation. In addition, 500 cycles are estimated for the pre-operational construction period and are included in the estimate of 2,000 cycles. Since the total number of cycles is at the low end of the allowable design value of 20,000 cycles, the Reactor Building crane load cycle assumption remains valid for the period of extended operation.

Fuel Handling Building Crane

The Fuel Handling Building crane is used primarily during spent fuel shipping cask operations and new fuel receiving. A conservative estimate of the number of cycles for 60 years of operation is 11,500 cycles. The rate of occurrence is based on refueling outages and the final core off load at the end of 60 years of operation. In addition, 500 cycles are estimated for the pre-operational construction period and are included in the estimate of 11,500 cycles. Since the total number of cycles is significantly less than the allowable design value of 20,000 cycles, the Fuel Handling Building crane load cycle assumption remains valid for the period of extended operation.

Emergency Service Water Pump House Crane

The Emergency Service Water Pump House crane is used for movement of heavy loads in the Emergency Service Water Pump House. A conservative estimate of the number of cycles for 60 years of operation is 2,000 cycles. The rate of occurrence is based on crane usage throughout the calendar year at 20 cycles per year. In addition, 500 cycles are estimated for the pre-operational construction period and are included in the estimate of 2,000 cycles. Since the total number of cycles is at the low end of the allowable design value of 20,000 cycles, the Emergency Service Water Pump House crane load cycle assumption remains valid for the period of extended operation.

Disposition:	10 CFR 54.21(c)(1)(i)	Crane load cycle assumptions remain valid for the period of extended operation.

4.6.2 MAIN STEAM LINE FLOW RESTRICTORS EROSION ANALYSIS

TLAA Description:

A main steam line flow restrictor is welded into each of the four main steam lines between the main steam relief valves and the inboard main steam isolation valve (MSIV). The restrictor assemblies consist of a stainless steel venturi-type nozzle welded into the carbon steel main steam line piping.

There is no specific analysis of main steam line flow restrictor erosion other than that presented in UFSAR Section 5.4.4, which indicates that only very slow erosion will occur with time and that such a slight enlargement will have no safety significance. Since the erosion analysis was based on 40 years of operation, erosion of the main steam line flow restrictor has been identified as a TLAA that requires evaluation for the period of extended operation.

TLAA Evaluation:

As discussed in the UFSAR Section 5.4.4, the resistance of stainless steel to erosion has been established by turbine inspections at another BWR plant that revealed no noticeable effects from erosion on the stainless steel nozzle partitions at similar steam velocities. Calculations indicate that even with erosion rates as high as 0.004 inches per year, after 40 years of operation the increase in choked flow rate would be no more than 5 percent.

The main steam line break accident is discussed in UFSAR Section 15.6.4. The analysis assumed the flow in each steam line was limited by critical flow at the restrictor to a maximum of 200 percent of rated flow for each line. Even if the choked flow rate is increased 8 percent to account for the additional 20 years of service the resulting mass flow rate is substantially less than 200 percent of rated flow assumed in the UFSAR main steam line break accident analysis. The analysis has been projected to the end of the period of extended operation.

Disposition:	10 CFR 54.21(c)(1)(ii)	The analysis has been projected to the end of the period of extended operation.

4.6.3 Reduction of Fracture Toughness for the Reactor Vessel Internals

TLAA Description:

The GE design specification for the PNPP core support structure (CSS) components of the reactor vessel internals includes requirements beyond the ASME design requirements for austenitic stainless steel components exposed to a fluence of greater than 1.0E+21 n/cm^2 for base metal and 5.0E+20 n/cm^2 for welds.

The neutron fluence thresholds for the CSS components of the reactor vessel internals in the GE design specification were developed for a design life of 40 years, therefore, this is a time-limited aging analysis requiring disposition for license renewal.

BWRVIP-26, BWRVIP-38, BWRVIP-41, and BWRVIP-48 [References 4.7-30, 4.7-31, 4.7-32, and 4.7-33] evaluated the effects of neutron fluence on specific reactor vessel internals and incorporated evaluations that are TLAAs.

TLAA Evaluation:

The GE design specification contains limits on neutron fluence and applied stress. It is known that neutron radiation reduces the toughness of austenitic stainless steels. Austenitic stainless steels are very ductile materials with high toughness in the unirradiated condition. This characteristic gives a failure mode predominantly governed by plastic collapse rather than fracture (either brittle fracture or ductile tearing). This characteristic is desirable with respect to design of the CSS since it is inherently more damage tolerant than brittle materials which can exhibit rapid and dramatic failure when applied loads exceed material resistance to unstable crack extension.

The GE design specification stress limits, weld joint design and weld quality requirements that are imposed when a fluence threshold is exceeded were developed during the plant design stage, at a time when the industry had far fewer data and associated management tools to understand and address the effects of neutron fluence. Subsequent to development of the GE design specification, the industry has generated a substantial amount of irradiated materials data through extensive research programs. Additional data have been gathered through experience gained from periodic inspections. These data form the basis for a robust set of guidance and aging management tools to address the effects of neutron fluence on the CSS.

The BWRVIP provides detailed guidance for managing the effects of aging, including the aging effects that are influenced by neutron fluence (i.e., cracking due to IASCC and reduction of fracture toughness due to neutron embrittlement). The PNPP CSS components are periodically examined in accordance with BWRVIP Inspection and Evaluation Guidelines. Guidance is also provided for use in evaluating any degradation identified by inspections. Evaluation guidance for the portions of the CSS that are subject to significant neutron fluence is supported by BWRVIP technical documents. These documents provide the technical bases for crack growth rates and fracture toughness values used to evaluate irradiated stainless steel materials. The BWRVIP is based on substantially greater data and operating experience than existed at the time the GE design specification was prepared. Further, the BWRVIP is credited by all U.S. BWRs to ensure management of the aging effects applicable to the CSS.

Therefore, reduction of fracture toughness for the reactor vessel internals will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii) by the BWR Vessel Internals Program.

Disposition:	10 CFR 54.21(c)(1)(iii)	The reduction of fracture toughness for the reactor vessel internals will be managed for the period of extended operation by the BWR Vessel Internals Program.

4.6.4 FATIGUE ANALYSIS -- EARTHQUAKE CYCLIC LOADING

TLAA Description:

UFSAR Section 3.7.3.2 identifies the design basis for earthquake cycles over the 40-year life of the plant used as input to the fatigue analyses for different classes of piping and components.

The earthquake cycles input into the fatigue analyses constitute a TLAA.

TLAA Evaluation:

UFSAR Section 3.7.4.4.2 describes a Richter Magnitude 5 earthquake that occurred on January 31, 1986, at Leroy, Ohio, approximately 11 miles to the south of Perry Nuclear Power Plant. The UFSAR Section provides the actions taken by PNPP to evaluate the impact of the earthquake and to verify that the plant did not sustain any related damage.

Since the January 31, 1986, earthquake, PNPP has not experienced any OBE events.

Disposition: 10 CFR 54.21(c)(1)(i) The assumptions related to the number of earthquakes cycles used as input to the fatigue analyses remain valid for the period of extended operation.

4.6.5 FATIGUE DUE TO PARTIAL FEEDWATER HEATING

TLAA Description:

Operation with partial feedwater heating (PFH), which is described in UFSAR Appendix 15D, occurs if (1) certain stage(s) or string(s) or an individual heater becomes inoperable, or (2) intentionally valving out the extraction steam to the feedwater heaters at the end of an operating cycle. The effect of PFH on the acoustic and flow induced loads on the reactor shroud, shroud support and jet pumps were re-investigated to ensure that design limits are not exceeded.

The evaluation of the cumulative usage factors for the feedwater nozzle and the sparger were provided in the UFSAR as follows:

Feedwater Nozzle -- the evaluation was performed on the PNPP feedwater nozzle with partial feedwater heating at rated feedwater temperature of 250°F for conservatism. An 18 month operating cycle with partial feedwater heating based on an 80% capacity factor is equivalent of 438 full power days per cycle. This results in an additional 0.0214 fatigue usage factor over 40 years of continuous operation at 250°F. Furthermore, if additional end of cycle operation with feedwater temperature between 420°F and 250°F for 41 full power days per cycle for 40 years is assumed, the resultant fatigue usage factor would increase by 0.001. The total fatigue usage factor will still be less than 0.8, which is below the limit of 1.0.

Sparger -- the evaluation was performed to examine the impact of partial feedwater heating operation on the feedwater sparger for PNPP. Six cases were analyzed to determine the number of days allowable per year (for 40 years) for partial feedwater heating operation without exceeding the feedwater sparger fatigue usage factor limit of 1.0. The results of this study determined the minimum annual average of 127 days allowable for partial feedwater heating reducing from normal 420°F to 370°F or 21 days reducing to 320°F rated feedwater temperature with an additional 41 end of cycle days at 250°F. The feedwater sparger is acceptable for partial feedwater heating operation within the specified limits.

The fatigue usage factor on the feedwater nozzles and spargers was evaluated using conservative assumptions for the 40-year life of the plant and found to remain below the limit of 1.0.

The analysis of operation with PFH is a TLAA.

TLAA Evaluation:

The fatigue usage for the feedwater nozzle was re-evaluated for the period of extended operation. The evaluation determined that the total fatigue usage factor will still be less than 0.8, which is below the limit of 1.0.

The effects of aging for the feedwater nozzles will be managed by the PNPP aging management program, BWR Feedwater Nozzle Program.

As indicated in Section 2.3.1.6, the sparger is not in scope for license renewal because it does not perform a license renewal intended function, its failure does not result in consequential failure of any safety-related equipment including the potential effects of loose parts, and it is not credited for any regulated events. However, the sparger is inspected as part of the BWRVIP, which will continue into the period of extended operation. Since the sparger is not in the scope of license renewal, this TLAA excludes the evaluation of the sparger.

The aging of the feedwater nozzles as a result of PFH operation will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii) by the BWR Feedwater Nozzle Program.

Disposition:	10 CFR 54.21(c)(1)(iii)	The effect of PFH operation on the feedwater nozzle will be managed for the period of extended operation by the BWR Feedwater Nozzle Program.

4.6.6 FATIGUE DUE TO SINGLE RECIRCULATION LOOP OPERATION

TLAA Description:

UFSAR Appendix 15F discusses single loop operation (SLO) and justifies that PNPP can safely operate with a SLO up to approximately 70% of rated thermal power. As part of the evaluation of SLO, the fatigue on the reactor vessel internals due to vibratory loading was evaluated. The evaluation showed that all internals components, except the in-core guide tubes, had adequate fatigue life without detailed analysis.

As provided in the UFSAR, a cumulative usage factor of 1 would indicate that crack initiation may occur in the component. The expected 40-year plant-life fatigue usage for in-core guide tubes from events other than single loop operation is 0.1. This leaves a fatigue usage of 0.9 for SLO.

The fatigue usage factor for the in-core guide tubes is 0.11 for 1 year of SLO. Thus:

(number of years of SLO) x (0.11) = 0.9

(number of years of SLO) = 0.9/0.11= 8.18

Based on this evaluation, it was conservatively concluded that the in-core guide tubes are structurally adequate to withstand flow-induced vibrations caused by 8 years of single loop operation.

This detailed fatigue analysis is a TLAA.

TLAA Evaluation:

The fatigue on the reactor vessel internals due to vibratory loading as a result of SLO was evaluated for 60 years of operation. The evaluation verified the conclusion in the UFSAR evaluation that all internals components, except the in-core guide tubes, had adequate fatigue life without detailed analysis. Therefore, only the fatigue for the in-core tubes was evaluated further.

As provided in the UFSAR evaluation, a cumulative usage factor of 1 would indicate that crack initiation may occur in the component.

The in-core guide tubes' fatigue factor of 0.11 for 1 year of operation does not change from the UFSAR evaluation.

The expected plant-life fatigue usage for events other than single loop operation is:

0.1 x (60 years / 40 years) = 0.15.

This leaves a fatigue usage of (1 – 0.15 = 0.85) for SLO.

Thus,

(number of years of SLO) x (0.11) = 0.85

(number of years of SLO) = 0.85 / 0.11 = 7.72

It can conservatively be concluded from these results that the in-core guide tubes are structurally adequate to withstand flow-induced vibrations caused by 7.72 years of single loop operation.

As of March 1, 2023, PNPP has been in SLO a total of approximately 1,843 hours, or 77 days, which is well within the evaluated allowable operating time.

The evaluation of the cumulative usage factor for the in-core guide tubes in SLO has been projected to the end of the period of extended operation.

Disposition: 10 CFR 54.21(c)(1)(ii) The evaluation of SLO has been projected to the end of the period of extended operation.

4.6.7 STEAM PIPING EROSION

TLAA Description:

PNPP submitted a comprehensive study, "Steam Erosion Hazards Analysis," [Reference 4.7-34] to verify that safe shutdown of the plant could be assured if a steam erosion-related break were to occur. The study performed the following tasks:

- Identified the safety class systems and components subject to possible steam erosion hazards,
- Determined which of these systems and components were not likely to fail due to steam erosion based on conservative, simplifying criteria,
- Identified systems and components which required a more detailed analysis to assure safe shutdown, and
- Conducted the required detailed analyses for the systems and components identified as requiring additional analysis.

The study concluded that the effects of steam erosion could not prevent safe shutdown for the 40 year life of the plant.

Additionally, in the response to an NRC request for additional information, PNPP identified that the piping potentially impacted by steam erosion is included in the Inservice Inspection Program [Reference 4.7-35].

This analysis is a TLAA.

TLAA Evaluation:

As discussed above the Steam Erosion Hazards Analysis determined that effects of steam erosion could not prevent safe shutdown of the plant. Based on the review of this study by the NRC, PNPP committed to monitoring the extraction steam (N36), high pressure and low pressure heater drains and vents (N25/26), and main, reheat, extraction, and miscellaneous drains (N22) systems via the inservice inspection program to mitigate/detect any effects of steam erosion [Reference 4.7-35].

The extraction steam and the high pressure and low pressure heater drains and vents systems are not in scope for license renewal as they do not perform a license renewal intended function, their failure would not result in failure of a safety-related function, and they are not credited for any regulated events. However, the commitment to monitor these systems with the inservice inspection program will continue into the period of extended operation.

The main, reheat, extraction, and miscellaneous drains system is in scope for license renewal. The effects of steam erosion for piping in this system will be monitored by the flow accelerated corrosion program.

Disposition:	10 CFR 54.21(c)(1)(iii)	The effects of steam erosion for the main, reheat, extraction, and miscellaneous drains system will be managed by the Flow Accelerated Corrosion Program.

4.6.8 Silicone Sealant in Engineered Safety Features (ESF) HVAC Ductwork

TLAA Description:

Silicone sealants are used in the ESF HVAC ductwork on a limited basis. PNPP performed a qualification program to demonstrate the capability of the sealant to perform its intended function for the 40 year life of the plant. This qualification program was submitted to the NRC by letter dated July 30, 1986 [Reference 4.7-28]. In addition to this qualification program, PNPP committed to perform routine monitoring of the applicable ESF ductwork and a sample of a ductwork/sealant combination [Reference 4.7-36].

The qualification of this silicone sealant for use in the ESF ductwork is a TLAA.

TLAA Evaluation:

As discussed above, PNPP committed to a monitoring program for the applicable ESF ductwork and a sample of the ductwork/sealant combination. The commitment for this monitoring program will continue into the period of extended operation and will be managed by the External Surfaces Monitoring of Mechanical Components AMP.

Disposition:	10 CFR 54.21(c)(1)(iii)	The silicone sealant in the ESF ductwork will be managed during the period of extended operation by the External Surfaces Monitoring of Mechanical Components AMP.

4.6.9 TOP GUIDE GRID BEAM NEUTRON FLUENCE

TLAA Description:

The evaluation of the fracture toughness of the reactor vessel internals discussed in LRA Section 4.6.3 is valid for the top guide grid beam. The neutron fluence thresholds of the design specification were based on a design life of 40 years.

The evaluation of the fracture toughness of the top guide grid beam is a TLAA.

TLAA Evaluation:

The top guide grid beam is a component included in the BWR Vessel Internals Program, which is described in Appendix B of this application. BWRVIP-26 [Reference 4.7-30] specifically addressed the effects of neutron fluence on this component and provided the results of a component-specific calculation to determine 60-year accumulated neutron fluence.

The reduction of fracture toughness for the top guide grid beam will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii) by the BWR Vessel Internals Program, which is described in Appendix B of this application.

Disposition:	10 CFR 54.21(c)(1)(iii)	The reduction of fracture toughness for the top guide grid beam will be managed for the period of extended operation by the BWR Vessel Internals Program.

4.6.10 JET PUMP FATIGUE ANALYSIS

TLAA Description:

The evaluation of the fracture toughness of the reactor vessel internals discussed in Section 4.6.3 is valid for the jet pump components. The neutron fluence thresholds of the design specification were based on a design life of 40 years.

The susceptibility of the jet pump components to fatigue is a TLAA.

TLAA Evaluation:

BWRVIP-41 [Reference 4.7-31] specifically addressed the effects loss of fracture toughness for the jet pump components and identified the susceptibility of these components to fatigue. The jet pump components are susceptible to two sources of fatigue -- system cycling fatigue and vibration fatigue. The jet pump components are included in the BWR Vessel Internals Program, which is described in Appendix B.

The loss of fracture toughness for the jet pump components will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii) by the BWR Vessel Internals Program., which is described in Appendix B.

Disposition:	10 CFR 54.21(c)(1)(iii)	The loss of fracture toughness for jet pump components will be managed for the period of extended operation by the BWR Vessel BWR Vessel Internals Program.

4.6.11 ALLOWABLE STRESS ANALYSIS OF BOP ASME CODE CLASS 1, 2 AND 3 COMPONENTS

TLAA Description:

As discussed in UFSAR Section 3.9.3.1.2, the balance of plant systems and components are identified in accordance with ASME Code Class and Safety Class. The design limits and load for the ASME Code Class 1, 2 and 3 systems are provided in UFSAR Tables 3.9-18 through 3.9-21a.

The stress calculations based on these limits are TLAAs.

TLAA Evaluation:

UFSAR Section 3.9.2.1 and 14.2.12 discuss the pre-operational dynamic testing performed to verify that system design stress limits are not exceeded.

The stress limits for BOP ASME Code Class 1, 2 and 3 components were determined based on the applicable portions of the ASME Code. Though the design requirements of the Code are somewhat affected by the assumed 40 year plant lifetime, these stress limits will remain applicable for the period of extended operation.

Additionally, the cumulative fatigue usage factors are addressed in Section 4.3.1 and Section 4.3.2.

Disposition:	10 CFR 54.21(c)(1)(i)	The allowable stress for the BOP ASME Code Class 1, 2 and 3 components remain valid for the period of extended operation.

4.6.12 RV ANNEALING

TLAA Description:

UFSAR Section 5.3.3.1.1.1 indicates that in-place annealing of the reactor vessel was evaluated and determined to be unnecessary because shifts in transition temperature caused by irradiation during the 40-year life could be accommodated.

The evaluation of the need for in-place annealing is a TLAA.

TLAA Evaluation:

The effects of neutron fluence on the reactor vessel have been evaluated in Section 4.2 of this application, which indicate that shifts in transition temperature can be accommodated during the period of extended operation. Therefore, the determination that in-place annealing of the reactor vessel is not necessary remains valid for the period of extended operation.

Disposition:	10 CFR 54.21(c)(1)(i)	The determination that in-place annealing of the reactor vessel is not necessary remains valid for the period of extended operation.

4.7 REFERENCES

4.7-1 10 CFR 50.60, *Acceptance Criteria for Fracture Prevention Measures for Lightwater Nuclear Power Reactors for Normal Operation*

4.7-2 PY-CEI/NRR-2627L, *License Amendment Request Pursuant to 10 CFR 50.90: Revision of Pressure/Temperature Limit Curves for Non-Nuclear Heatup/Cooldown, Core Critical Operation, and Pressure Testing for Reactor Coolant Systems; Including an Exemption Request Pursuant to 10 CFR 50.60(b)*, June 4, 2002 (ML021650244)

4.7-3 *DOCKET NO. 50-440 Perry Nuclear Power Plant, Unit No. 1 Facility Operating License, Amendment No. 187* (ML053040355)

4.7-4 *Safety Evaluation by the Office of Nuclear Reactor Regulation BWRVIP-145, BWR Vessel and Internals Project, Evaluation of Susquehanna, Unit 2 Top Guide and Core Shroud Material Samples Using RAMA Fluence Methodology*, February 7, 2008 (ML080390160)

4.7-5 NRC Regulatory Guide 1.190, *Calculational and Dosimetry Methods for Determining Vessel Neutron Fluence*, U.S. NRC, March 2001

4.7-6 10 CFR 50 Appendix G, *Fracture Toughness Requirements*

4.7-7 NRC Regulatory Guide 1.99, Revision 2, *Radiation Embrittlement of Reactor Vessel Materials*, May 1988

4.7-8 Letter L-14-150, *Request for Licensing Action to Amend Technical Specification 3.4.11, "RCS Pressure and Temperature (P/T) Limits*, June, 23, 2014 (ML14174A633)

4.7-9 BWRVIP-05, *BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations* (BWRVIP-05), September 1995

4.7-10 BWRVIP-05 SER (Final), USNRC letter from Gus C. Lainas to Carl Terry, Niagara Mohawk Power Company, BWRVIP Chairman, *Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report*, (TAC No. M93925), July 28, 1998

4.7-11 *BWRVIP-74 SER (FINAL), USNRC letter from Christopher I. Grimes to Carl Terry, Niagara Mohawk Power Company, BWRVIP Chairman, Acceptance For Referencing of EPRI Proprietary Report TR-113596, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flow Evaluation Guidelines (BWRVIP-74)" and Appendix A, "Demonstration of Compliance With the Technical Information Requirements of the License Renewal Rule (10 CFR 54.21)*, 10/18/2001

4.7-12 BWRVIP-108NP: BWR Vessel and Internals Project, *Technical Basis for the Reduction of Inspection Requirements for the Boiling Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Blend Radii*, EPRI, Palo Alto, CA, 2007

4.7-13 Not Used

4.7-14 Ranganath, S., *Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident*, Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, August 1979, Paper G1/5

4.7-15 General Electric Report No. NEDO-10029, *An Analytical Study on Brittle Fracture of GE-BWR Vessels Subject to the Design Basis Accident*, L.C. Hsu, June 1969

4.7-16 10 CFR 50.49 *Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants*

4.7-17 NUREG-0588, Revision 1, *Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment*, July 1981

4.7-18 NRC Regulatory Guide 1.89, Revision 1, *Environmental Qualification of Certain Electrical Equipment Important to Safety for Nuclear Power Plants*, June 1984

4.7-19 CMAA-70-75, *Crane Manufacturer's Associate of America Specification 70, Specifications for Electric Overhead Traveling Cranes*, Copyright 1975

4.7-20 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 2

4.7-21 NUREG/CR-6260, *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, February 1995

4.7-22 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 2

4.7-23 NUREG/CR-6909, *Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials*, February 2007

4.7-24 NUREG/CR-6909, Rev. 1, *Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials*, Draft Report for Comment, March 2014.

4.7-25 EPRI Report No. TR-1012017, *Guidance for Performing Environmental Fatigue Evaluations (MRP-47, Revision 1)*, Palo Alto, CA, September 2005

4.7-26 *BWRVIP-74-A, BWR Vessel and Internals Project BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal, June 2003*

4.7-27 *Perry Nuclear Power Plant, Unit No. 1 – Issuance of Amendment Concerning Changes To Pressure Temperature Curves* (TAC NO. MF4351)(L-14-150), June 12, 2015 (ML15141A482)

4.7-28 PY-CEI/NRR-0505, Environmental Qualification of Silicone Sealants FSAR App. IB, Item 17 SSER 8, 6.5, July 30, 1986

4.7-29 PY-CEI/NRR-0002L, *Control of Heavy Loads Study*, 1/14/1983

4.7-30 BWRVIP-26-A, *BWR Vessel and Internals Project, BWR Top Guide Inspection and Flaw Evaluation Guidelines*, November 2004

4-7-31 BWRVIP-41, Revision 4-A, *BWR Vessel and Internals Project, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines*, December 2018

4.7-32 BWRVIP-38, *BWR Vessel and Internals Project, BWR Shroud Support Inspection and Flaw Evaluation Guidelines*, September 1997

4.7-33 BWRVIP-48, Revision 1, *BWR Vessel and Internals Project, Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines*, June 2019

4.7-34 PY-CEI/NRR-0069L, *ASLB Issue No. 15 – Steam Erosion*, 8/31/1983

4.7-35 PY-CEI/NRR-0109L, *ASLB Issue Number 15 Steam Erosion*, 5/15/1984

4.7-36 PY-CEI/NRR-0703L, *License Commitment 17, Silicone Sealant*, August 27, 1987

4.7-37 NEI 95-10, Revision 6, *Industry Guideline for Implementing the Requirements of 10 CFR 54 the License Renewal Rule*

4.7-38 BWRVIP-329-A, *Updated Probabilistic Fracture Mechanics Analyses for BWR RPV Welds to Address Extended Operations*, December 2021

4.7-39 NUREG-0612 *Control of Heavy Loads at Nuclear Power Plants,* July 1980

APPENDIX A

UPDATED FINAL SAFETY ANALYSIS REPORT SUPPLEMENT

Updated Final Safety Analysis Report Supplement
Table of Contents

A.0 UPDATED FINAL SAFETY ANALYSIS REPORT SUPPLEMENT

This appendix provides the information to be submitted in an Updated Final Safety Analysis Report (UFSAR) Supplement as required by 10 CFR 54.21(d) for the Perry Nuclear Power Plant (PNPP) License Renewal Application (LRA). The LRA contains the technical information required by 10 CFR 54.21(a) and (c). Section 3 contains the results of the aging management reviews. Appendix B describes the programs and activities credited to manage the effects of aging. Section 4 documents the evaluations of time-limited aging analyses for the period of extended operation. Section 3, Section 4, and Appendix B have been used to prepare the program and activity descriptions that are contained in this appendix.

This appendix is divided into three sections:

- Section A.1 contains summary descriptions of the programs and activities credited to manage the effects of aging during the period of extended operation;
- Section A.2 contains summaries of the evaluations of time-limited aging analyses for the period of extended operation;
- Table A.3 contains a listing of the commitments associated with license renewal.

The information presented in these three sections will be incorporated into the PNPP UFSAR following issuance of the renewed operating license in accordance with 10 CFR 50.71(e).

A.1 SUMMARY DESCRIPTIONS OF AGING MANAGEMENT PROGRAMS AND ACTIVITIES

The license renewal integrated plant assessment and evaluation of time-limited aging analyses identified existing and aging management programs necessary to provide reasonable assurance that components within the scope of license renewal will continueto perform their intended functions consistent with the current licensing basis for the period of extended operation.

This section describes the aging management programs and activities identified during the integrated plant assessment and evaluation of time-limited aging analyses. The aging management programs and activities will be implemented as identified in the list of license renewal commitments (see Table A-3).

Three elements of an effective aging management program that are common to each of the aging management programs are corrective actions, confirmation process, and administrative controls. These elements are included in the Quality Assurance Program Manual for the PNPP, which implements the requirements of 10 CFR 50, Appendix B. The corrective actions, confirmation process, and administrative controls in the Quality Assurance Program Manual to be applied to the credited aging management programs and activities for the structures and components determined to require aging management, are consistent with the related discussions in the Appendix on Quality

Assurance for Aging Management Programs in NUREG-1801.

Operating experience from plant-specific and industry sources is captured and systematically reviewed on an ongoing basis in accordance with the quality assurance program, which meets the requirements of 10 CFR 50, Appendix B, and the operating experience program, which meets the guidance of NUREG-0737, *Clarification of TMI Action Plan Requirements*, Item I.C.5, *Procedures for Feedback of Operating Experience to Plant Staff*. The operating experience program interfaces with and relies on active participation in the Institute of Nuclear Power Operations' operating experience program, as endorsed by the NRC. In order to provide additional assurance that internal and external operating experience related to aging management is used effectively during the Period of Extended Operation (PEO), PNPP evaluates operating experience items to determine whether they may involve age-related degradation or aging management impacts. Research and development from appropriate sources (i.e., EPRI, INPO, and ASME) will also be reviewed.

Plant-specific operating experience, including aging-related operating experience, is documented in Condition Reports (CRs), and processed using the PNPP Corrective Action Program consistent with LR-ISG-2011-05, *Ongoing Review of Operating Experience*. The Corrective Action Program database includes an "Aging" flag to identify plant-specific operating experience concerning age-related degradation to structures and components within the scope of license renewal and managed by a license renewal Aging Management Program (AMP). CRs documenting adverse conditions as captured in the Corrective Action Program database are quality records and are auditable and retrievable. The identified CRs related to aging management issues are assigned to the AMP owners, and as a result, the pertinent AMPs will be either be enhanced, or new AMPs developed, as appropriate, when it is determined through these evaluations that the effects of aging may not be adequately managed.

Training on age-related degradation and aging management will be provided to those personnel responsible for implementing the AMPs and to those who may review, screen, assign, evaluate, or otherwise process site-specific and industry OE. Plant-specific OE associated with aging management and age-related degradation is reported to the industry in accordance with guidelines established in the PNPP OE Program

While the programs and procedures may specify reviews of certain sources of information, such as NRC generic communications, revisions to NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," and Institute of Nuclear Power Operations reports, they allow for any potential source of relevant plant-specific or industry operating experience information.

PNPP will continue the existing operating experience program to evaluate age-related degradation or aging management impacts to structures and components to manage aging management program effectiveness and determine the need for new programs consistent with LR-ISG-2011-05.

The NUREG-1801 Chapter XI Aging Management Programs (AMPs) are described in Section A.1. The AMPs are either consistent with generally accepted industry methods as discussed in NUREG-1801 or require enhancements. The AMP descriptions provide the status of these programs at the time of the PNPP License Renewal Application submittal.

Following the description of the AMPs, Section A.2 contains a listing of the NUREG-1801 Chapter X time-limited aging analyses. Commitments for program additions and enhancements are identified in the Table A.3.

Table A.1 below provides a summary and reference of the aging management programs for PNPP with respect to consistency with NUREG-1801 listed by aging management program. Following this table, each aging management program credited for PNPP license renewal is addressed alphabetically in this section.

Table A.1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	Program Status	LRA Sections
X.M1	Fatigue Monitoring	Fatigue Monitoring	Existing	A.1.19 B.2.19
X.S1	Concrete Containment Tendon Prestress	Not applicable. PNPP does not have pre-stressed tendons in the containment structure.	N/A	N/A
X.E1	Environmental Qualification (EQ) of Electric Components	Environmental Qualification (EQ) of Electrical Components	Existing	A.1.17 B.2.17
XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	Existing	A.1.3 B.2.3
XI.M2	Water Chemistry	Water Chemistry	Existing	A.1.44 B.2.44
XI.M3	Reactor Head Closure Stud Bolting	Reactor Head Closure Stud Bolting	Existing	A.1.39 B.2.39
XI.M4	BWR Vessel ID Attachment Welds	BWR Vessel ID Attachment Welds	Existing	A.1.13 B.2.13
XI.M5	BWR Feedwater Nozzle	BWR Feedwater Nozzle	Existing	A.1.10 B.2.10
XI.M6	BWR Control Rod Drive Return Line Nozzle	BWR Control Rod Drive Return Line Nozzle	Existing	A.1.9 B.2.9
XI.M7	BWR Stress Corrosion Cracking	BWR Stress Corrosion Cracking	Existing	A.1.12 B.2.12
XI.M8	BWR Penetrations	BWR Penetrations	Existing	A.1.11 B.2.11

Table A.1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	Program Status	LRA Sections
XI.M9	BWR Vessel Internals	BWR Vessel Internals	Existing	A.1.14 B.2.14
XI.M10	Boric Acid Corrosion	PWR Only	N/A	N/A
XI.M11B	Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs only)	PWR Only	N/A	N/A
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Not applicable. PNPP RCPB CASS components consist of valve bodies, pump casings and the main steam flow restrictors (4 ea.). The valve bodies and pump casings are excluded from screening. The restrictors are not susceptible to thermal aging embrittlement since they are composed of low-molybdenum CASS (CF8) with a ferrite content of less than 20 percent as confirmed by CMTRs.	N/A	N/A
XI.M16A	PWR Vessel Internals	PWR Only	N/A	N/A
XI.M17	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion	Existing	A.1.22 B.2.22
XI.M18	Bolting Integrity	Bolting Integrity	Existing	A.1.7 B.2.7
XI.M19	Steam Generators	PWR Only	N/A	N/A
XI.M20	Open-Cycle Cooling Water System	Open-Cycle Cooling Water System	Existing	A.1.37 B.2.37
XI.M21A	Closed Treated Water Systems	Closed Treated Water Systems	Existing	A.1.15 B.2.15
XI.M22	Boraflex Monitoring	Not applicable. PNPP does not use Boraflex panels in its spent fuel pool racks.	N/A	N/A

Table A.1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	Program Status	LRA Sections
XI.M23	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Existing	A.1.26 B.2.26
XI.M24	Compressed Air Monitoring	Compressed Air Monitoring	Existing	A.1.16 B.2.16
XI.M25	BWR Reactor Water Cleanup System	Not applicable. RWCS piping downstream of 2nd isolation valve is CS and therefore, not subject to GL 88-01	N/A	N/A
XI.M26	Fire Protection	Fire Protection	Existing	A.1.20 B.2.20
XI.M27	Fire Water System	Fire Water System	Existing	A.1.21 B.2.21
XI.M29	Aboveground Metallic Tanks	Aboveground Metallic Tanks	New	A.1.2 B.2.2
XI.M30	Fuel Oil Chemistry	Fuel Oil Chemistry	Existing	A.1.23 B.2.23
XI.M31	Reactor Vessel Surveillance	Reactor Vessel Surveillance	Existing	A.1.40 B.2.40
XI.M32	One-Time Inspection	One-Time Inspection	New	A.1.35 B.2.35
XI.M33	Selective Leaching	Selective Leaching	New	A.1.42 B.2.42
XI.M35	One-time Inspection of ASME Code Class 1 Small Bore-Piping	One-Time Inspection of ASME Code Class 1 Small Bore-Piping	New (One-Time)	A.1.36 B.2.36
XI.M36	External Surfaces Monitoring of Mechanical Components	External Surfaces Monitoring of Mechanical Components	New	A.1.18 B.2.18

Table A.1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	Program Status	LRA Sections
XI.M37	Flux Thimble Tube Inspection	Not applicable. PNPP is a GE design that does not have flux thimble tubes.	N/A	N/A
XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	New	A.1.25 B.2.25
XI.M39	Lubricating Oil Analysis	Lubricating Oil Analysis	Existing	A.1.28 B.2.28
XI.M40	Monitoring of Neutron-Absorbing Materials Other than Boraflex	Monitoring of Neutron-Absorbing Materials Other Than Boraflex	Existing	A.1.30 B.2.30
XI.M41	Buried and Underground Piping and Tanks	Buried and Underground Piping and Tanks	Existing	A.1.8 B.2.8
XI.M42	Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	Internal Coatings and Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks	New	A.1.27 B.2.27
XI.S1	ASME Section XI, Subsection IWE	ASME Section XI, Subsection IWE	Existing	A.1.4 B.2.4
XI.S2	ASME Section XI, Subsection IWL	ASME Section XI, Subsection IWL	Existing	A.1.6 B.2.6
XI.S3	ASME Section XI, Subsection IWF	ASME Section XI, Subsection IWF	Existing	A.1.5 B.2.5
XI.S4	10 CFR Part 50, Appendix J	10 CFR 50, Appendix J	Existing	A.1.1 B.2.1
XI.S5	Masonry Walls	Masonry Walls	New	A.1.29 B.2.29
XI.S6	Structures Monitoring	Structures Monitoring	Existing	A.1.43 B.2.43
XI.S7	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Existing	A.1.41 B.2.41

Table A.1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	Program Status	LRA Sections
XI.S8	Protective Coating Monitoring and Maintenance Program	Protective Coating Monitoring and Maintenance Program	Existing	A.1.38 B.2.38
XI.E1	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Insulated Cables and Connections Program	Existing	A.1.34 B.2.34
XI.E2	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Non-EQ Instrumentation Circuits Program	New	A.1.33 B.2.33
XI.E3	Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Inaccessible Power Cables Program	Existing	A.1.32 B.2.32
XI.E4	Metal Enclosed Bus	Not applicable. There are no in-scope metal enclosed bus for PNPP	N/A	N/A
XI.E5	Fuse Holders	Fuse Holders	New	A.1.24 B.2.24
XI.E6	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Electrical Cable Connections Program	New (One-Time)	A.1.31 B.2.31

A.1.1 10 CFR 50, APPENDIX J PROGRAM

The 10 CFR Part 50, Appendix J Program is an existing performance monitoring program that monitors containment leakage rates. Containment leak rate tests are required to assure that: (a) leakage through primary Containment and systems and components penetrating primary Containment will not exceed allowable values specified in technical specifications, and (b) periodic surveillance of primary Containment penetrations and isolation valves is performed so that proper maintenance and repairs are made. Appendix J, Option B is used. The Containment leak rate tests are performed in accordance with the guidelines contained in Nuclear Energy Institute (NEI) 94-01, Revision 3-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J, and the conditions and limitations specified in NEI 94-01, Revision 2-A, of the same name, dated October 2008.

Prior to performance of the Integrated Leak Rate Test (Type A test), general visual examinations (VT-3) are conducted on the containment accessible interior and exterior surface areas in accordance with ASME Section XI, Subsections IWE (AMP XI.S1), and IWL (AMP XI.S2) to detect evidence of degradation that may affect structural integrity.

The program will be continued for the period of extended operation.

A.1.2 ABOVEGROUND METALLIC TANKS PROGRAM

The Aboveground Metallic Tanks Program is a new condition monitoring program that manages loss of material for the nonsafety-related, uninsulated steel (with internal coating) condensate storage tank (CST), which is located outdoors on sand and concrete. Preventive measures to mitigate corrosion were applied during construction, such as using the appropriate materials and use of a protective multi-layer vapor barrier beneath the tank. The concrete ring foundation is filled with layers of bitumen coated sand supporting the tank bottom, slightly sloping toward the tank drain sump. The protective layers of sand beneath the tank serve as a seal at the concrete-to-tank interface. Both the concrete ring foundation and the layers of vapor barrier sand are supported by a reinforced concrete foundation. There are no indoor tanks included in this program. The tank internal surfaces and internal coatings will be managed by XI.M42, *Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks*. An exterior visual inspection of the tank will occur at least once each operating cycle beginning no later than six months prior to the period of extended operation. UT examination from the inside of the tank to assess the thickness of the bottom against the design specified thickness will be conducted no later than six months prior to the period of extended operation and continue each 10 years thereafter.

A.1.3 ASME SECTION XI INSERVICE INSPECTION, SUBSECTIONS IWB, IWC, AND IWD PROGRAM

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program is an existing condition monitoring program that meets the in-service inspection requirements specified by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section XI, as modified by 10 CFR 50.55a.

The program includes periodic visual, surface and volumetric examination and leakage (pressure) testing of American Society of Mechanical Engineers (ASME) Class 1, 2, or 3 pressure-retaining components, and their integral attachments, as well as repair, modification or replacement of same. This program will also manage the aging effects of the reactor vessel support skirt. Also, the program has been augmented to include Operating Experience (OE), UFSAR and regulatory commitments beyond 10 CFR 50.55a(g), and inspection guidance issued under the NEI 03-08, *Materials Degradation* initiative. In addition, risk informed inservice inspections for Class 1 and Class 2 piping welds and Class 3 or Non-Class Components are conducted in accordance with Code Case N716-1, *Alternative Piping Classification and Examination Requirements. Section XI, Division 1.*

The applicable ASME Code for the current (fourth) 10 year inspection interval for PNPP, which commenced on May 18, 2019 is the ASME XI, 2013 Edition as modified by 10 CFR50.55a or relief granted in accordance with 10 CFR 50.55a.

In accordance with 10 CFR 50.55a(g)(4)(ii), the ISI program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified 12 months before the start of the inspection interval. Any deviation from ASME Code, Section XI requirements must be approved by the NRC per a relief request.

The program will be continued for the period of extended operation.

A.1.4 ASME SECTION XI, SUBSECTION IWE PROGRAM

The American Society of Mechanical Engineers (ASME) Section XI, Subsection IWE Program is an existing condition monitoring program that establishes responsibilities and requirements for conducting ASME Boiler and Pressure Vessel (B&PV) Code Section XI, Subsection IWE inspections as required by 10 CFR 50.55a and the additional requirements specified in 10 CFR 50.55a(b)(2). The program consists of examinations for accessible surface areas of containment Class MC pressure retaining components. The containment is a GE Mark III steel containment design. There are no moisture barriers, and no high strength bolting (actual measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi)) within the PNPP IWE boundary.

The program includes periodic VT-3 visual examinations of the pressure-retaining components for signs of degradation, assessment of damage, and corrective actions. The program specifies acceptance criteria and expansion of the inspection scope when degradation exceeding the acceptance criteria is found. Acceptance criteria include no structural deformation or degradation such that the component's function is impaired, no missing or detached items, erosion or corrosion of structural metal does not exceed 10% of the design wall thickness, no gross flaking, peeling or blistering of coatings, and no excessive debris accumulation. A visual VT-1 examination is required for bolted connections when flaws or degradation are identified. IWE-1240 requires augmented examinations (Examination Category E-C) of containment surface areas subject to degradation and includes VT-1 visual examination for areas accessible from both sides, and volumetric (ultrasonic thickness measurement) examination for areas accessible from only one side.

The applicable ASME Code for the current (fourth) 10-year inspection interval for PNPP, which commenced May 18, 2019 and expires on May 17, 2029, is ASME XI, 2013 Edition, as modified by 10 CFR 50.55a or relief granted in accordance with 10 CFR 50.55a. There are currently no relief requests granted for the fourth 10 year inspection interval for components subject to the examination requirements of ASME Section XI, Subsection IWE.

In accordance with 10 CFR 50.55a(g)(4)(ii), the ASME Section XI, Subsection IWE Program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME B&PV Code specified 12 months before the start of the inspection interval. Any deviation from ASME B&PV Code, Section XI requirements must be approved by the NRC per a relief request.

The program will be continued for the period of extended operation.

A.1.5 ASME Section XI, Subsection IWF Program

The ASME Section XI, Subsection IWF Program is an existing condition monitoring program that meets the in-service inspection requirements specified by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section XI, as modified by 10 CFR 50.55a. The program manages aging of ASME Class 1, 2, and 3 supports. There are no Class MC supports at PNPP; containment is free-standing.

The IWF scope of inspection for supports is based on sampling of the total support population. The sample size varies depending on the ASME Class. The largest sample size is specified for the most critical supports (ASME Class 1). The sample size decreases for the less critical supports (ASME Class 2 and 3). The primary inspection method employed is VT-3 visual examination. Supports not meeting the acceptance standards of IWF-3400 are evaluated through the Corrective Action Program. Discovery of support deficiencies during regularly scheduled inspections triggers an increase of the inspection scope in order to ensure that the full extent of deficiencies is identified.

The applicable ASME Code for the current (fourth) 10 year inspection interval for PNPP, which commenced May 18, 2019 and expires on May 17, 2029, is ASME XI, 2013 Edition, as modified by 10 CFR 50.55a or relief granted in accordance with 10 CFR 50.55a. There are currently no relief requests granted for the fourth 10 year inspection interval for components subject to the examination requirements of ASME Section XI, Subsection IWF.

In accordance with 10 CFR 50.55a(g)(4)(ii), the ASME Section XI, Subsection IWF Program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified 12 months before the start of the inspection interval. Any deviation from ASME Code, Section XI requirements must be approved by the NRC per a relief request.

The program will be enhanced as follows:

1. The program will be enhanced to include preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi)).

2. The program will be enhanced to include preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.

3. The program will be enhanced to specify that, in addition to VT-3 examination, high strength bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch nominal diameter, shall receive a volumetric examination in accordance with the requirements of ASME Code Section V, Article 5, Appendix IV. The representative sample size will be equal to 20 percent (rounded up to the nearest whole number) of the entire IWF population (for a given ASTM specification) of high strength bolts in sizes greater than 1 inch nominal diameter, with a maximum sample size of 25 bolts. The selection of the representative sample will consider susceptibility to stress corrosion cracking (e.g., actual measured yield strength) and ALARA principles. The frequency of examination will be once each 10-year ISI Interval.

4. The program will also be enhanced to revise plant procedures to specify the following conditions as unacceptable:

   - Loss of material due to corrosion or wear that reduces the load bearing capacity of the component support.
   - Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support.
   - Cracked or sheared bolts, including high strength bolts, and anchors.

These enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.6 ASME Section XI, Subsection IWL Program

The ASME Section XI, Subsection IWL program is an existing condition monitoring program that establishes responsibilities and requirements for conducting American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section XI, Subsection IWL inspections as required by 10 CFR 50.55a and the additional requirements specified in 10 CFR 50.55a(b)(2). The scope of the ASME Section XI, Subsection IWL Program includes reinforced concrete for the containment annulus (Class CC). Unbonded post-tensioning system is not applicable at PNPP.

PNPP's containment vessel is a free-standing steel cylinder with an ellipsoidal dome, secured to a steel lined reinforced concrete foundation mat. The containment vessel is designed, fabricated, and erected in accordance with the requirements of the ASME Code Section III, Subsection NE, for Class MC components. At its base, in the annular region between the containment vessel and the shield building, reinforced concrete has been installed. This annulus concrete provides stiffness to the steel containment vessel to reduce the dynamic response of the steel containment vessel due to the postulated safety relief valve discharge loading phenomena. The annulus concrete is designed to the requirements of the ASME Code Section III, Division 2, Subsection CC, and Code Case N-258 - "Design of Interaction Zones for Concrete Containments Section III, Division 2," March 1980, with proposed Revision 1.

The IWL program includes periodic visual examinations of the accessible areas of the annulus concrete. The frequency of examination is once every five years. The program specifies acceptance criteria, corrective actions, and expansion of the inspection scope when degradation exceeding the acceptance criteria is found. The program acceptance criteria for the examinations are provided in IWL-2510, which references American Concrete Institute (ACI) 201.1R and ACI 349.3R for identification of concrete degradation.

In accordance with 10 CFR 50.55a(b)(2)(viii), the program specifies additional requirements for inaccessible areas. When conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas, an evaluation of the acceptability of the concrete in the inaccessible areas is required.

The applicable ASME Code for the current (fourth) 10-year inspection interval for PNPP, which commenced May 18, 2019 and expires on May 17, 2029, is ASME XI, 2013 Edition, as modified by 10 CFR 50.55a or relief granted in accordance with 10 CFR 50.55a. There are currently no relief requests granted for the fourth 10-year inspection interval for components subject to the examination requirements of ASME Section XI, Subsection IWL.

In accordance with 10 CFR 50.55a(g)(4)(ii), the ASME Section XI, Subsection IWL program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified 12 months before the start of the inspection interval. Any deviation from ASME Code, Section XI requirements must be approved by the NRC per a relief request.

The program will be enhanced as follows:

1. Areas of concrete deterioration and distress will be recorded in accordance with the guidance provided in ACI 349.3R.

2. The acceptance criteria will be based on ACI 349.3R for identification of concrete degradation. Quantitative acceptance criteria based on the "Evaluation Criteria" provided in Chapter 5 of ACI 349.3R will be used to augment the qualitative assessment of the Responsible Engineer.

The enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.7 Bolting Integrity Program

The Bolting Integrity Program is an existing condition monitoring and preventive program that, with enhancement, will manage cracking, loss of material and loss of preload for pressure retaining bolting using preventive measures and inspection activities. The program includes preload control, selection of bolting material, use of lubricants/sealants, and performance of periodic inspections for indication of aging effects.

The general practices that are established in this program are consistent with the recommendations, as delineated in NUREG-1339, *Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*, EPRI NP-5769, *Degradation and Failure of Bolting in Nuclear Power Plants* (with the exceptions noted in NUREG-1339 for safety-related bolting) and EPRI TR-104213, *Bolted Joint Maintenance and Applications Guide*.

The Bolting Integrity Program is supplemented by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, for inspection of safety-related closure bolting on pressure-retaining joints. The bolting integrity program is supplemented by the External Surfaces Monitoring of Mechanical Components Program for managing the integrity of non-ASME pressure retaining bolted joints. The integrity of non-ASME pressure-retaining bolted joints is evaluated by detection of visible leakage, evidence of past leakage, or other age-related degradation including loose or missing fasteners during walkdowns and maintenance activities (at least once per refueling outage). The corrective action program is used to document and manage identified leakage.

Procurement controls and installation practices, defined in plant procedures, include preventive measures to ensure that only approved lubricants/sealants (precludes the use of sulfur) are used. Bolting replacement activities include proper torquing of the bolts and checking for uniformity of the gasket compression after assembly.

The following bolting is not included in the Bolting Integrity program.

- The Primary Containment (MC) pressure-retaining bolting is managed as part of the ASME Section XI, Subsection IWE Program.
- ASME Class 1, 2, 3, and MC piping and components support bolting, including NSSS component supports, is managed as part of the ASME Section XI, Subsection IWF Program.
- Structural bolting, other than ASME Class 1, 2, 3, and MC piping and components support bolting, is managed as part of the Structures Monitoring Program, and R.G. 1.127 Inspection of Water-Control Structures Associated with Nuclear Power Plants Program.
- Crane and hoist bolting is managed by Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program.
- Inspection activities for bolting in a buried environment or underground with restricted access are performed in conjunction with buried piping and component inspections performed as part of the Buried and Underground Piping and Tanks Program.
- Reactor head closure bolting is managed by the Reactor Head Closure Stud Bolting Program.

The program will be enhanced as follows:

1. High strength bolting (regardless of code classification) will be monitored for cracking in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-G-1.
2. Perform visual inspection of submerged bolting for the Emergency Service Water pumps, diesel and motor fire pumps, emergency service water screen wash pumps and Spent Fuel Rack Grid Structure for loss of material and loss of preload on a 10 year frequency.
3. Perform visual inspection of submerged bolting for the Emergency Core Cooling Systems (ECCS) and Reactor Core Isolation Cooling (RCIC) system suction strainer in the suppression pool for loss of material and loss of preload (loose or missing nuts and bolts) on a 10 year frequency.
4. Acceptance criteria for high strength structural bolting shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section V, Article 5, Appendix IV.
5. Preventive measures will include using bolting material that has an actual measured yield strength limited to less than 1,034 megapascals (MPa) (150 kilo-pounds per square inch [ksi]).

The enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.8 BURIED AND UNDERGROUND PIPING AND TANKS PROGRAM

The Buried and Underground Piping and Tanks Program is an existing condition monitoring program that manages the aging effects associated with the external surfaces of buried and underground piping and tanks such as loss of material, cracking, and changes in material properties (for cementitious piping).

The program also manages aging through actions that include protective coatings, backfill quality, and cathodic protection as preventive measures to mitigate corrosion. The number of inspections is based on the effectiveness of the preventive and mitigative actions.

Annual cathodic protection surveys are conducted. The acceptance criteria for the effectiveness of the cathodic protection is less than or equal to -850 mV (-690 mV for Test Well 50). Where the acceptance criteria is not met, loss of material rates are measured.

Inspections are conducted by qualified individuals. Sample sizes of exposed piping examined are increased when the depth or extent of degradation of base metal could result in loss of pressure boundary function when extrapolated to the end of the period of extended operation.

Directed inspections are conducted during each 10-year period beginning 10 years prior to commencing the period of extended operation. The first inspection will be completed no later than six months prior to the period of extended operation.

The program will be enhanced as follows:

1. Site procedures will be enhanced to:
    - Identify the systems containing buried or underground piping within the scope of license renewal.
    - Describe opportunistic inspections.
    - Describe cathodic protection.
    - Describe fire jockey pump monitoring.
    - Describe the directed underground and buried inspections.

The enhancement will be implemented no later than six months prior to the period of extended operation.

A.1.9 BWR Control Rod Drive Return Line Nozzle Program

The BWR Control Rod Drive Return Line (CRDRL) Nozzle aging management program is an existing condition monitoring program that manages the effects of cracking in the CRDRL reactor pressure vessel nozzle. The CRDRL nozzle has been capped to mitigate thermal fatigue cracking. The Control Rod Drive System did not utilize a return line to the reactor vessel. Therefore, augmented inspections in accordance with NUREG-0619 and Generic Letter 80-095 are not required. The program includes volumetric ultrasonic examinations of the CRDRL nozzle-to-reactor vessel welds and the nozzle inner radius in accordance with ASME Code, Section XI, Subsection IWB, Table IWB-2500-1. The CRDRL nozzle-to-nozzle safe-end and the nozzle safe-end-to-cap weld examinations are performed in accordance with Code Case N-716-1.

The program will be continued for the period of extended operation.

A.1.10 BWR Feedwater Nozzle Program

The BWR Feedwater Nozzle Program is an existing condition monitoring program that manages the effects of cracking in the reactor vessel feedwater nozzles exposed to reactor coolant. The program provides for examination of feedwater nozzles for cracking in accordance with the requirements of ASME Code, Section XI and of NUREG-0619, Revision 1, *BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10 (Technical Report)*, as modified by the BWR Owners Group Licensing Topical Report, GE-NE-523-A71-0594-A, Revision 1, *Alternate BWR Feedwater Nozzle Inspection Requirements*. The program is implemented through the plant in-service inspection (ISI) program and includes periodic ultrasonic test (UT) examination of the feedwater nozzles.

The program will be continued for the period of extended operation.

A.1.11 BWR Penetrations Program

The BWR Penetrations Program aging management program is an existing condition monitoring program that includes the inspection and evaluation recommendations within BWRVIP-27-A, BWRVIP-47-A, and BWRVIP-49-A and the requirements of the ASME Code, Section XI. The program is implemented through station procedures that provide for managing the effects of cracking of the reactor vessel instrumentation penetrations, standby liquid control (SLC) nozzles/Core ΔP nozzles, and control rod drive (CRD) housing and incore-monitoring housing penetrations exposed to reactor coolant through inspections and water chemistry.

The following enhancement will be completed no later than 6 months prior to entering the period of extended operation:

1. The inservice inspections procedures will be revised to incorporate BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively.

A.1.12 BWR Stress Corrosion Cracking Program

The BWR Stress Corrosion Cracking Program is an existing condition monitoring and mitigation program that manages intergranular stress corrosion cracking (IGSCC) in reactor coolant pressure boundary piping and piping components made of stainless steel and nickel-based alloy in a reactor coolant environment. The program implements the program delineated in NUREG-0313, Revision 2, *Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping* and NRC Generic Letter (GL) 88-01, *NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping, including* Supplement 1. The program includes preventive measures to mitigate IGSCC, and inspection and flaw evaluation to monitor IGSCC and its effects.

Reactor coolant water chemistry is controlled and monitored as described in the Water Chemistry Program. Hydrogen Water Chemistry and Noble Metals Chemical Addition have been implemented to further reduce susceptibility of the piping systems exposed to reactor coolant to IGSCC. Mechanical Stress Improvement Process (MSIP) or weld overlay has been performed on several welds determined to be susceptible to IGSCC.

The BWR Stress Corrosion Cracking Program is implemented through the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The inspection frequency for welds is in accordance with NRC GL 88-01, including Supplement 1, as modified by BWRVIP-75-A, *BWR Vessel and Internals Project Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules.*

The program will be continued for the period of extended operation.

A.1.13 BWR Vessel ID Attachment Welds Program

The BWR Vessel ID Attachment Welds aging management program is an existing condition monitoring program that includes the inspection and evaluation recommendations within BWRVIP-48 and the requirements of ASME Code, Section XI, Subsection IWB. The program is implemented through station procedures that provide for mitigation of cracking of reactor vessel internal components through management of reactor water chemistry and monitoring for and evaluation of cracking through in-vessel examinations of the reactor vessel internal attachment welds.

At least 6 months prior to entering the period of extended operation the following enhancement will be completed:

1. The inservice inspections procedures will be revised to incorporate BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively.

A.1.14 BWR VESSEL INTERNALS PROGRAM

The BWR Vessel Internals Program is an existing condition monitoring program that includes inspection and flaw evaluation in accordance with the requirements of the ASME Code, Section XI and the guidelines of applicable and staff-approved BWRVIP documents. The program manages the effects of cracking, loss of material and loss of fracture toughness of vessel internal components in a reactor coolant or steam environment. The program also mitigates these aging effects by managing water chemistry per the Water Chemistry Program.

The program will include aging management of reactor internal components fabricated from cast austenitic stainless steel for loss of fracture toughness due to thermal aging and neutron embrittlement and components fabricated from Alloy X-750 material to provide for timely identification of cracks that may be indicative of degradation due to embrittlement.

The program will be enhanced as follows:

1. The BWR Vessel Internals Program implementing station procedures will be revised to incorporate BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively.

2. An evaluation of the 60-year fluence for the six (6) critical components identified in BWRVIP-234, Table 6-1, will be performed to verify the applicability of the BWRVIP to PNPP. In the unlikely circumstance that the 60-year fluence limits for one or more these components are exceeded, an assessment of the susceptibility of reactor vessel internal components fabricated from CASS to loss of fracture toughness due to thermal aging and neutron irradiation embrittlement will be performed. The required periodic inspections of CASS components determined to be susceptible to loss of fracture toughness due to thermal aging and neutron irradiation embrittlement will be determined based on this assessment.

The enhancement will be implemented no later than six months prior to the period of extended operation.

A.1.15 CLOSED TREATED WATER SYSTEMS PROGRAM

The Closed Treated Water Systems Program is an existing mitigation and condition monitoring program that manages loss of material, cracking, and reduction of heat transfer due to fouling in components exposed to a closed treated water environment through monitoring and control of water chemistry, including the use of corrosion inhibitors, chemical testing, and visual inspections of internal surface condition. The *Closed Cooling Water Chemistry Guideline*, industry guidance, and vendor recommendations are used to delineate the program.

The program will be enhanced as follows:

1. The program will be enhanced to ensure aging effects are detected through periodic inspections. Visual inspections will be conducted whenever the system boundary is opened. Additionally, a representative sample of piping and components will be selected based on likelihood of corrosion or cracking and inspected at an interval not to exceed once in 10 years. |

2. The program will be enhanced to change the chemical treatment of the Building Heating System from a hydrazine-based regime to one more suitable to the elevated system temperatures experienced at PNPP.

These enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.16 COMPRESSED AIR MONITORING PROGRAM

The Compressed Air Monitoring Program is an existing condition monitoring program that manages loss of material in compressed air systems by periodically monitoring air samples for moisture and contaminants and by opportunistically inspecting internal surfaces within compressed air systems. The Compressed Air Monitoring program is based on the PNPP response to NRC Generic Letter 88-14, *Instrument Air Supply Problems Affecting Safety-Related Components,* and utilizes guidance and standards provided in INPO Significant Operating Report 88-01, *Instrument Air System Failures*. The UFSAR states the Compressed Air Monitoring meets the design requirements of ANSI Standard MC-11-1 (ISA-S7.3) with the exception that maximum allowable particle size for air to safety-related equipment is 40 microns. Program activities include air quality checks at various locations to ensure that dew point, particulates, and hydrocarbons are maintained within the specified limits.

Air quality is monitored and trended to determine if alert levels or limits are being approached or exceeded. Particulates, dew points, and hydrocarbon content are monitored. The Compressed Air Monitoring Program will include opportunistic inspections, when components are opened for maintenance, repair, or surveillance to ensure that the existing environmental conditions are not causing material degradation that could result in a loss of component intended function during the period of extended operation.

The program will be enhanced as follows:

1. Include opportunistic inspections of accessible internal surfaces of piping, receivers, compressors, dryers, aftercoolers, and filters within the compressed air systems.

2. A new monitoring and trending program will be developed to monitor and trend periodic dew point readings, results of each opportunistic visual inspection, and annual air samples

These enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.17 Environmental Qualification (EQ) of Electrical Components Program

The Environmental Qualification (EQ) of Electrical Components Program is an existing program that implements the requirements of 10 CFR 50.49. Equipment will be replaced or refurbished prior to reaching the end of its qualified life. Reanalysis is conducted on a routine basis to address analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria and corrective actions. Reanalysis is conducted in a timely manner (i.e., sufficient time is available to refurbish, replace, or re-qualify the component if the reanalysis is unsuccessful).

In accordance with 10 CFR 54.21(c)(1)(iii), implementation of the EQ Program provides reasonable assurance that the effects of aging will be managed such that EQ components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The program will be continued for the period of extended operation.

A.1.18 External Surfaces Monitoring of Mechanical Components Program

The External Surfaces Monitoring of Mechanical Components Program is a new condition monitoring program that will manage aging effects of components fabricated from metallic and elastomeric materials through periodic visual inspection of external surfaces during system inspections and walkdowns for evidence of leakage, loss of material (including loss of material due to wear), and cracking, and change in material properties of elastomeric structural commodities. The visual inspection of elastomers will detect change in material properties such as cracking or crazing, swelling, discoloration and melting. Physical manipulation (of at least 10% of available surface area), such as touching, pressing, flexing, and bending, will be used to augment visual inspections to confirm the absence of hardening and loss of strength in elastomeric materials. The program in-scope elastomers are associated with ventilation flexible connections and duct. The periodic inspections will include visual inspection of insulation jacketing to ensure the integrity of the jacketing is maintained.

The program is also credited with managing loss of material from internal surfaces of metallic components and with loss of material, cracking, and change in material properties from the internal surfaces of elastomers, for cases in which material and environment combinations are the same for internal and external surfaces such that external surface condition is representative of internal surface condition.

The inspections of external surfaces will be capable of detecting age-related degradation. Surfaces that are inaccessible or not readily visible during either normal plant operations or refueling outages will be inspected opportunistically and at such intervals that will ensure the components' intended function is maintained during the period of extended operation. Surfaces that are accessible will be inspected at an interval not to exceed one operating cycle. Inspections will be performed by personnel qualified through plant-specific programs. Deficiencies will be documented and evaluated under the Corrective Action Program.

Outdoor insulated components, and indoor insulated components exposed to condensation (because the in-scope component is operated below the dew point), will have portions of the insulation inspected or removed, during each 10-year interval of the period of extended operation, to determine whether the exterior surface of the component is degrading or has the potential to degrade.

The program will be implemented no later than six months prior to the period of extended operation. Visual inspection of external surfaces will be conducted once every refueling cycle. A sample of insulated piping will be inspected every ten years during the period of extended operation. Inspections will commence during the period of extended operation.

A.1.19 FATIGUE MONITORING PROGRAM

The Fatigue Monitoring aging management program is an existing preventive program that manages fatigue damage of reactor coolant pressure boundary and other components subject to the reactor coolant, treated water, steam, and air-indoor uncontrolled environments. The program ensures that the cumulative fatigue usage remains within allowable ASME Code limits by tracking the critical thermal and pressure transients for selected systems and components and evaluating the resulting incremental fatigue. The program includes monitoring the transients consistent with Technical Specification 5.5.5, Component Cyclic or Transient Limits, UFSAR Tables 3.9-1 and 3.9-2, and UFSAR Figures 3.9-24 through 3.9-30. To accomplish the fatigue evaluation, the program considers the number of transients, the severity of monitored transients, and the impact of the reactor coolant environment.

The program provides for the collection and trending of data associated with the reactor pressure vessel, the reactor coolant pressure boundary components, and the containment vessel. The program calculates cumulative usage factors (CUFs) and requires corrective actions if design limits are approached. This is accomplished by the use of cycle-based fatigue monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0 (or 0.1 for high energy line break exclusion criteria), including environmental effects where applicable.

The effect of the reactor coolant environment on component fatigue life has been determined by performing environmental fatigue analyses for a sample of critical locations selected using NUREG/CR-6260 guidance. Additional environmental fatigue analyses were performed for limiting locations in the reactor coolant pressure boundary. Environmentally-adjusted fatigue usage factors (CUF_{en}) were computed in accordance with the guidance specified in NUREG/CR-6909 for the affected materials.

The Fatigue Monitoring aging management program will be enhanced to:

1. Clarify the scope of the Fatigue Monitoring Program within the implementing station procedures.
2. Include environmental correction factors (F_{en} multipliers) for the locations where monitoring the environmental fatigue has been determined to be applicable to ensure the cumulative fatigue, including environmental fatigue, does not exceed the ASME Code, Section III limits.

These enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.20 FIRE PROTECTION PROGRAM

The Fire Protection Program is an existing condition monitoring and performance monitoring program that manages the aging effects for components in the scope of license renewal that have a fire barrier function. The program requires periodic visual inspection of fire barrier penetration seals; fire barrier walls, ceilings, and floors; and periodic visual inspection and functional tests of fire-rated doors to ensure that their operability is maintained. The program also includes periodic inspection and testing of the carbon dioxide (CO_2) fire suppression systems. There are no in-scope halon fire suppression systems.

The Fire Protection AMP requires visual inspections of penetration fire seals, fire barrier walls, ceilings, and floors in structures within the scope of LR are performed at a frequency in accordance with the plant's NRC-approved fire protection program. The frequency of visual inspections of the fire door surfaces and functional testing of fire door closing mechanisms and latches is also in accordance with the plant's NRC-approved fire protection program.

The program will be continued for the period of extended operation.

A.1.21 FIRE WATER SYSTEM PROGRAM

The Fire Water System Program (a sub-program of the overall Fire Protection Program) is an existing condition monitoring program that applies to the fire water supply and water-based suppression systems, which include sprinklers, nozzles, fittings, valve bodies, fire pump casings and heat exchanger, hydrants, hose stations, standpipes, a pressure maintenance tank, various retarding chambers (tank), Foam Liquid Storage Tank (component types Tank), and aboveground, buried and underground piping and components. The PNPP Fire Water System does not have a fire water storage tank. The program conducts tests and inspections in accordance with applicable National Fire Protection Association (NFPA) codes and standards and enhanced flow testing and visual inspections performed in accordance with the 2011 Edition of NFPA 25.

The Fire Water System Program after enhancements implemented effectively manages loss of material due to corrosion and erosion, including fouling, and flow blockage because of fouling; change in material properties of fiberglass reinforced piping and reduction in heat transfer. This program manages the aging effects using flow testing and visual inspections. When visual inspections are used to detect loss of material, including loss of material due to recurring internal corrosion, the inspection technique is capable of detecting surface irregularities that could indicate wall loss to below nominal pipe wall thickness due to corrosion and corrosion product deposition. The water-based fire protection system is normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

Testing or replacement of sprinkler heads that have been in service for 50 years will be performed in accordance with the 2011 Edition of NFPA 25. Portions of the water-based fire water system that (a) are normally dry, but periodically subject to flow (e.g., dry-pipe or downstream of the deluge valve in a deluge system); and (b) cannot be drained or allow water to collect are subject to augmented examination beyond that specified in NFPA 25. The augmented examinations for the portion of normally dry piping that are periodically wetted or experience recurring internal corrosion include (a) periodic full flow tests at the design pressure and flow rate, or internal inspections; and (b) volumetric wall thickness evaluations. In addition, if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material will be removed and its source will be determined and corrected. For the buried piping, visual inspections of the piping interior surfaces will be performed whenever the piping internal surface is made accessible due to maintenance and repair activities.

The program will be enhanced as follows:

1. The program will include inspections and testing consistent with Appendix L, Table 4a, Fire Water System Inspection and Testing Recommendations, of License Renewal Interim Staff Guidance LR-ISG-2012-02.

2. As an enhancement to detect aging effects of internal surfaces of buried piping, a portion of the aboveground inspection locations will be selected where above-grade and underground or buried piping environments and material are similar, the above-grade can be extrapolated to evaluate the condition of the underground or buried piping.

3. The program will require that when visual inspections are used to detect loss of material, including loss of material in the piping within the scope of license renewal due to recurring internal corrosion, the inspection technique is capable of detecting surface irregularities that could indicate wall loss to below nominal pipe wall thickness due to corrosion and corrosion product deposition. Where such irregularities are detected, follow-up volumetric wall thickness examinations will be performed.

4. The program will include augmented testing and inspections beyond those of Table 4a for portions of water-based fire protection system components within the scope of license renewal that are (a) normally dry but periodically subjected to flow (e.g., dry-pipe or preaction sprinkler system components) and (b) cannot be drained or allow water to collect:

    - In each 5-year interval, beginning 5 years prior to the period of extended operation, a flow test or flush sufficient to detect potential flow blockage will be conducted, or a visual inspection of 100 percent of the internal surface of piping segments will be conducted.

    - In each 5-year interval of the period of extended operation, 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect will be subject to volumetric wall thickness inspections. Measurement points will be obtained to the extent that each potential degraded condition can be identified (e.g., general corrosion, MIC). The 20 percent of piping inspected in each 5-year interval will be in different locations than previously inspected piping.

    - If the results of a 100-percent internal visual inspection are acceptable, and the segment is not subsequently wetted, no further augmented tests or inspections are necessary.

5. The program will perform representative sprinkler head sampling (laboratory field service testing) or replacement of sprinkler heads within the scope of license renewal prior to 50 years in-service (installed), and at 10-year intervals thereafter, in accordance with the 2011 Edition of NFPA 25, or until there are no untested sprinkler heads that will see 50 years of service through the end of the period of extended operation.

6. The program will require at a minimum of once per 10 year interval visual inspection of the engine heat exchanger for the diesel driven fire water pump to monitor for conditions that could cause a reduction in heat transfer.

7. The program will provide that if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material will be removed, and its source will be determined and corrected.

These Fire Water System Program enhancements described above will be implemented no later than 6 months prior to the extended period of operation.

A.1.22 FLOW-ACCELERATED CORROSION PROGRAM

The Flow-Accelerated Corrosion (FAC) Program is an existing condition monitoring program based on the Electric Power Research Institute (EPRI) guidelines in the Nuclear Safety Analysis Center (NSAC) EPRI NSAC-202L, *Recommendations for an Effective Flow-Accelerated Corrosion Program*, to ensure that the integrity of piping systems susceptible to FAC is maintained. The program consists of a) performing an analysis to determine systems susceptible to FAC, b) conducting appropriate analyses to predict wall thinning, c) performing wall thickness measurements based on wall thinning predictions and operating experience, and d) evaluating measurement results to determine the remaining service life and the need for replacement or repair of components.

The FAC Program relies on implementation of the EPRI NSAC-202L guidelines and on internal and external operating experience. The program uses a predictive code for portions of susceptible systems with design and operating conditions that are amenable to computer modeling. Inspections are performed using ultrasonic or other approved testing techniques capable of determining wall thickness. Field measurements are used to corroborate the results of the predictive code and to recalibrate the model as appropriate. The time remaining before the component reaches the minimum allowable wall thickness is predicted using inspection results (i.e., measured data) and other methods to estimate the wear rate.

The FAC aging management program also manages wall thinning in piping, piping components, and piping elements that are susceptible to mechanisms other than FAC, such as cavitation, flashing, droplet impingement, and solid particle impingement, when periodic monitoring is used in lieu of eliminating the cause of these various erosion mechanisms.

The program will be enhanced as follows:

1. Site procedures will be enhanced to include pump casings and valve bodies that retain pressure in systems susceptible to FAC. Opportunistic inspections of internal surfaces are conducted during routine maintenance activities to identify degradation.

This enhancement will be implemented no later than six months prior to the period of extended operation.

A.1.23 FUEL OIL CHEMISTRY PROGRAM

The Fuel Oil Chemistry Program is an existing condition monitoring, prevention and mitigation program that manages cracking, loss of material due to corrosion, and fouling that results in corrosion in piping and components exposed to an environment of diesel fuel oil. Prevention and mitigation are accomplished by verifying the quality of fuel oil and controlling fuel oil contamination as well as periodic draining, cleaning, and inspection of fuel oil tanks.

Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the plant's technical specifications, ASTM standards, Surveillances, and maintenance procedures. Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by periodic draining or cleaning of tanks, by verifying the quality of new oil before its introduction into the storage tanks, and addition of a biocide.

The fuel oil tanks are visually inspected internally for signs of moisture, contaminants and corrosion. Internal tank inspections will be performed at least once during the ten-year period prior to the period of extended operation, and at least once every ten years during the period of extended operation. Volumetric inspection will be performed if visual inspection is not possible, or evidence of degradation is observed during visual inspection. Inspection frequencies are in accordance with the plant's technical specifications and applicable industry standards and guidance documents.

The effectiveness of the Fuel Oil Chemistry Program is verified by the One-Time Inspection.

The program will be enhanced as follows:

1. Additional information will be placed in Periodic Maintenance tasks. Periodic Maintenance tasks for the Diesel Fire Pump Fuel Oil Storage Tank will be revised to reflect that the minimum required schedule for inspections to satisfy Aging Management Program requirements are consistent with a 10-year interval.

2. Volumetric inspection will be performed if visual inspection is not possible, or evidence of degradation is observed during visual inspection.

These Fuel Oil Chemistry Program enhancements described above will be implemented no later than 6 months prior to the extended period of operation.

A.1.24 FUSE HOLDERS PROGRAM

The Fuse Holders Program is a new Condition Monitoring program that applies to fuse holders within the scope of license renewal and located outside of active devices that have been identified as susceptible to aging effects. Fuse holders located inside an active device are not within the scope of this program. Fuse holders subject to increased resistance of connection due to chemical contamination, corrosion, and oxidation or fatigue caused by ohmic heating, thermal cycling or electrical transients will be tested by thermography, contact resistance testing, or other appropriate testing methods for indications of the condition of the metallic clamps of the fuse holders.

The thermographic, contact resistance, or other tests will be performed at least once every 10 years, with the first test completed no later than six months prior to the period of extended operation.

A.1.25 INSPECTION OF INTERNAL SURFACES IN MISCELLANEOUS PIPING AND DUCTING COMPONENTS PROGRAM

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new condition monitoring program that will include visual inspections of the internal surface of in-scope components that are not included in other aging management programs for cracking, loss of material, and reduction in heat transfer. The program will include inspections of the internal surfaces of piping, piping components and piping elements, ducting, heat exchanger components, and other components that are exposed to environments of uncontrolled indoor air; outdoor air; condensation, moist air, diesel exhaust, fuel oil, lubricating oil, and any water environment other than open-cycle cooling water, closed treated water, and fire water. Aging effects identified for elastomers, both internal and external surfaces, will be managed by the External Surfaces Monitoring Program. License renewal in-scope polymers have no identified aging effects requiring management.

The internal inspections will be performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. At a minimum, in each 10-year period during the period of extended operation a representative sample of 20 percent of the population (defined as components having the same combination of material, environment, and aging effect) or a maximum of 25 components per population will be inspected. Where practical, the inspections will focus on the bounding or lead components most susceptible to aging because of time in service, and severity of operating conditions. Opportunistic inspections will continue in each period despite meeting the sampling limit. The program will include visual inspections to ensure that existing environmental conditions are not causing material degradation that could result in a loss of the component’s intended function.

Visual inspections will include all accessible internal surfaces. Unless otherwise required (e.g., by the ASME code), inspections will be carried out using plant-specific procedures by inspectors qualified through plant-specific programs. The inspections will be capable of detecting the aging effect(s) under consideration. Indications of relevant conditions of degradation detected during the inspections will be evaluated and compared to acceptance criteria.

Conditions that do not meet the acceptance criteria will be entered into the Corrective Action Program for evaluation. Any indications of relevant degradation will be evaluated using design standards, procedural requirements, current licensing basis, and industry codes or standards.

This AMP does not manage components in which recurring internal corrosion is a known issue. OE has not identified instances of recurring internal corrosion for components within the scope of this program.

Inspections begin during the period of extended operation.

The program will be implemented no later than six months prior to the period of extended operation.

A.1.26 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS PROGRAM

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program is an existing condition monitoring program that manages loss of material and loss of preload for bolting for cranes, trolley and bridge structural components, fuel handling equipment and applicable rails within the scope of license renewal. Visual inspections will manage loss of material due to corrosion of structural members and bolting, loss of material due to wear of rails, and loss of preload for bolted connections.

The cranes, monorails and hoists within the scope of license renewal are those defined by NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants*, and light load equipment handling systems related to refueling operations.

Crane preventive maintenance inspections are performed in accordance with the requirements of American National Standards Institute (ANSI) B30.2-1976 for overhead and gantry cranes and the vendor service manuals. For those cases where requirements differ, the more stringent requirement is applied. For cranes that are infrequently in service, such as the reactor building crane (a.k.a., polar crane), a verification is required that preventive maintenance inspections have been completed no more than one year (365 days) prior to each use. Also, the cranes comply with the maintenance rule requirements provided in 10 CFR 50.65.

The program will be continued for the period of extended operation.

A.1.27 INTERNAL COATINGS/LININGS FOR IN-SCOPE PIPING, PIPING COMPONENTS, HEAT EXCHANGERS, AND TANKS PROGRAM

The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks Program is a new condition monitoring program that will perform periodic visual inspections of internal coatings of in-scope components. The program will manage the loss of coating integrity in heat exchangers, piping, piping components, piping elements, and tanks.

Inspections will be performed for signs of coating failures and precursors to coating failures including peeling, delamination, blistering, cracking, flaking, chipping, rusting, and mechanical damage. When acceptance criteria are not met, physical testing will be performed where physically possible (i.e., sufficient room to conduct testing) in conjunction with repair or replacement of the coating/lining. Inspection results that do not satisfy established acceptance criteria will be entered into the corrective action program. The training and qualification of individuals involved in coating/lining inspections of non-cementitious coatings/linings will be conducted in accordance with ASTM International standards endorsed in RG 1.54 including guidance from the NRC staff associated with a particular standard. For cementitious coatings, training and qualifications will be based on an appropriate combination of education and experience related to inspecting concrete surfaces. The maximum interval of subsequent coating inspections will be consistent with Table 4a of GALL Report AMP XI.M42 in LR-ISG-2013-01, *Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks*.

The program will be implemented no later than six months prior to the period of extended operation.

Baseline coating/lining inspections will be performed in the 10-year period prior to the period of extended operation and begin no later than six months prior to the period of extended operation. New implementing documents have been developed to support these activities.

A.1.28 LUBRICATING OIL ANALYSIS PROGRAM

The Lubricating Oil Analysis Program is an existing prevention and mitigation program that manages oil environments in order to prevent loss of material and reduction of heat transfer. The program maintains oil contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to loss of material or reduction of heat transfer. The program provides sampling, analysis, and monitoring activities in order to identify detrimental contaminants, such as water and particulates. Water and particulate contaminant levels are trended, and recommendations are made when adverse trends are observed, including in-leakage and corrosion product build-up. Sampling frequencies and acceptance criteria for water and particulate concentrations are consistent with vendor and industry guidelines and may be augmented by PNPP sampling results. Corrective actions are initiated when the component's oil sample has phase separated water in any amount or water content exceeds an establish limit.

The XI.M32, *One-Time Inspection Program* will be used to verify the effectiveness of the Lubricating Oil Analysis Program.

The program will be continued for the period of extended operation.

A.1.29 Masonry Walls Monitoring Program

The masonry walls aging management program is a new condition monitoring program that will be performed under the structures monitoring aging management program, to be implemented no later than six months prior to the period of extended operation.

A.1.30 MONITORING OF NEUTRON-ABSORBING MATERIALS OTHER THAN BORAFLEX PROGRAM

The Monitoring of Neutron-Absorbing Materials other than Boraflex Program is an existing condition monitoring program that will manage reduction of neutron-absorbing capacity, change in dimensions and loss of material to ensure that aging of the Boral® neutron-absorbing material used in the spent fuel storage racks does not invalidate the spent fuel pool criticality analysis.

The condition monitoring program consists of periodic in-situ inspections and testing of the Boral® panels in the spent fuel pool. Inspections will monitor geometry changes in the Boral® panels caused by blistering, pitting and bulging. Testing will include areal density measurements of the boron in the Boral® panels. The results will be evaluated against acceptance criteria and previous inspections to determine whether corrective actions are required. If required, appropriate actions will be taken to ensure the required five percent sub-criticality margin is maintained. Monitoring of the Boral® panels in the spent fuel pool will be performed on a ten-year frequency.

A.1.31 NON-EQ Electrical Cable Connections PROGRAM

The Non-EQ Electrical Cable Connections Program is a one-time test, using thermography augmented with contact resistance testing, on a sampling basis to ensure that either aging of metallic cable connections is not occurring and/or that the existing preventive maintenance program is effective such that a periodic inspection program is not required. The one-time test confirms the absence of age-related degradation of cable connections resulting from increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation.

The representative sample considers voltage level (medium and low voltage), circuit loading (high loading), connection type (bolted connections, ring tongue lugs or butt splices) and location (high temperature, high humidity, vibration, etc.). The sample will include Unit 2 components that support Unit 1 operations with a license renewal intended function. The technical basis for the sample selection will be documented. If an unacceptable condition or situation is identified in the selected sample, a determination will be made as to whether the same condition or situation is applicable to other connections not tested. The corrective action program is used to evaluate the condition and determine appropriate corrective action.

The inspection will be performed via the use of thermography, augmented with contact resistance testing, no later than six months prior to the period of extended operation.

A.1.32 NON-EQ INACCESSIBLE POWER CABLES PROGRAM

The Non-EQ Inaccessible Power Cables Program is an existing Cable Aging Management Program that, after enhancement, will provide reasonable assurance that the intended functions of inaccessible or underground power cables that are not subject to the environmental qualification requirements of 10 CFR 50.49 and exposed to wetting or submergence perform their intended function in accordance with the current licensing basis through the period of extended operation.

In-scope power cables (greater than or equal to 400V) in inaccessible or underground locations exposed to significant moisture are tested at least once every six (6) years to provide an indication of the condition of the conductor insulation. The specific type of test performed is one or more of the following: Dielectric Loss (Dissipation Factor/Power Factor), AC Voltage Withstand, Partial Discharge, Step Voltage, Time Domain Reflectometry, Insulation Resistance and Polarization Index, Line Resonance Analysis, or other testing that is state-of-the-art at the time the tests are performed. The frequency of testing will be established and adjusted based on test results and operating experience. Initial testing will be completed no later than six months prior to the period of extended operation.

In addition, manholes and vaults associated with the in-scope power cables are inspected for water accumulation, and the water removed as necessary. After enhancement, the proper operation of dewatering systems and alarms will be verified, and the water removed as necessary. Verification of dewatering systems and alarms ensures the pumps and alarms are operable prior to event-driven occurrences (such as heavy rain or flooding). The inspections ensure that, following heavy rain or flooding events, dewatering will occur as required to ensure cable is not subject to significant moisture. The inspection frequency for proper operation of dewatering systems and alarms is established and performed based on plant-specific operating experience with cable wetting or submergence and at least annually. The initial inspections will be completed no later than six months prior to the period of extended operation.

The program will be enhanced as follows:

1. Dewatering sump pumps and alarms will be installed in all electrical manholes containing cable with a license renewal intended function.

2. Daily operator rounds will confirm that sump pumps and associated alarms are operable. When the high water level alarm has been on two days in a row, the need for supplemental pumps will be evaluated. When high level has occurred three days in a row, supplemental pumps will be used, as needed, and an engineering evaluation of affected power cable ≥400V in that manhole will be performed. The evaluation may use testing as a diagnostic tool but will consider the significance of the inspection results, the functionality of affected component, potential reportability of the event, the extent of the concern, the potential causes for not meeting the inspection criteria, the corrective actions required, and the likelihood of recurrence.

3. Inspections will be conducted at least annually to determine that cables are not wetted or submerged, that cables/splices and cable support structures are intact, and that sump pumps and associated alarms operate properly.

4. Maintenance plans will be enhanced to ensure all underground in-scope cable ≥400V is tested every six years.

The Non-EQ Inaccessible Power Cables Program enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.33 NON-EQ INSTRUMENTATION CIRCUITS PROGRAM

The Non-EQ Instrumentation Circuits Program is a new program that will manage the aging effects of the applicable cables and connections in the neutron monitoring and process radiation monitoring systems or subsystems. The program assures the intended functions of sensitive, high-voltage, low-signal cables exposed to adverse localized equipment environments caused by heat, radiation and moisture will be maintained consistent with the current licensing basis through the period of extended operation. Most sensitive instrumentation circuit cables and connections are included in the instrumentation loop calibration at the normal calibration frequency, which provides sufficient indication of the need for corrective actions based on acceptance criteria related to instrumentation loop performance. The review of calibration results will be performed once every ten years, with the first review occurring no later than six months prior to the period of extended operation.

For sensitive instrumentation circuit cables that are disconnected during instrument calibrations, testing using a proven method for detecting deterioration for the insulation (such as insulation resistance tests or time domain reflectometry) will occur at least once every ten years, with the first test occurring no later than six months prior to the period of extended operation. Applicable industry standards and guidance documents will be used to delineate the program.

The first surveillance review or insulation resistance (IR) testing will be completed no later than six months prior to the period of extended operation.

A.1.34 NON-EQ INSULATED CABLES AND CONNECTIONS PROGRAM

The Non-EQ Insulated Cables and Connections Program is an existing cable monitoring program. The program will provide reasonable assurance that the intended functions of insulated cables and connections exposed to adverse localized environments caused by temperature, radiation, or moisture can be maintained consistent with the current licensing basis through the period of extended operation. The program will provide for the periodic visual inspection of accessible, non-environmentally qualified electrical cables and connections, in order to determine if age-related degradation is occurring. Accessible electrical cables and connections installed in adverse localized environments will be visually inspected for signs of accelerated age-related degradation such as embrittlement, discoloration, cracking, melting, swelling, or surface contamination.

The Non-EQ Insulated Cables and Inspection Program visual inspections will be performed on a 10-year interval, with the first inspection completed no later than six months prior to the period of extended operation.

The program will be enhanced as follows:

1. The program will be enhanced to include a plant-specific procedure for plant walkdowns of adverse localized environments.

The enhancement will be implemented no later than six months prior to the period of extended operation.

A.1.35 ONE-TIME INSPECTION PROGRAM

The One-Time Inspection Program is a new program that will include a one-time inspection of selected components to verify the effectiveness of the Fuel Oil Chemistry, the Lubricating Oil Analysis, and the Water Chemistry aging management programs which are designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. The One-Time Inspection Program provides inspections that verify that unacceptable degradation is not occurring. It also may trigger additional actions that ensure the intended functions of affected components are maintained during the period of extended operation.

The elements of the program include (a) determination of the sample size of components to be inspected based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience,(b) identification of the inspection locations in the system or component based on the potential for the aging effect to occur, (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined, and (d) an evaluation of the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the period of extended operation.

The inspection includes a representative sample of the system population and focuses on the bounding or lead components most susceptible to aging due to time in service, and severity of operating conditions. A representative sample size is 20% of the population (defined as components having the same material, environment, and aging effect combination) or a maximum of 25 components. Otherwise, a technical justification of the methodology and sample size used for selecting components for one-time inspection will be included as part of the program's documentation.

The program relies on established NDE techniques, including visual, ultrasonic, and surface techniques. Inspections will be performed by personnel qualified in accordance with site procedures and programs to perform the type of examination specified. For American Society of Mechanical Engineers (ASME) Code components, examinations will follow procedures consistent with the ASME Code and 10 CFR 50 Appendix B. For non-code components, examinations will follow site procedures that include requirements for items such as lighting, presence of protective coatings, and cleaning processes that ensure an adequate examination. Acceptance criteria will be based on applicable ASME or other appropriate standards, design basis information, or vendor-specified requirements and recommendations.

The program cannot be used for structures or components with known age-related degradation mechanisms or when the environment in the period of extended operation is not expected to be equivalent to that in the prior 40 years. Periodic inspections should be proposed in these cases.

The program does not address Class 1 piping less than 4 inches nominal pipe size (NPS) 4. That piping is addressed in AMP XI.M35, *One Time Inspection of ASME Code Class 1 Small Bore-Piping*.

The inspections will be completed within 10 years of, but no later than six months prior to the period of extended operation.

A.1.36 ONE-TIME INSPECTION OF ASME CODE CLASS 1 SMALL BORE-PIPING PROGRAM

The one-time inspection of ASME Code Class 1 small-bore piping aging management program is a new condition monitoring program that will manage cracking of piping in a reactor coolant environment. The program will perform one-time inspection of a sample of ASME Code Class 1 piping less than 4-inches nominal pipe size (NPS) and greater than or equal to 1-inch NPS. The program includes pipes, fittings, branch connections, full penetration (butt) welds and partial penetration (socket) welds.

Cracking of ASME Code Class 1 small-bore piping due to stress corrosion cracking, cyclical (including thermal, mechanical, and vibration fatigue) loading, thermal stratification or thermal turbulence has not been experienced at PNPP. Therefore, this one-time inspection program is applicable and adequate to manage this aging effect during the period of extended operation. Program inspections will augment ASME Code, Section XI requirements.

For the current fourth 10-year interval, the ISI program applies the requirements of ASME Code, Section XI, 2013 Edition. Any deviation from ASME Code, Section XI requirements must be approved by the NRC per a relief request. The current ISI program for the fourth 10-year interval includes periodic volumetric ultrasonic testing of selected Class 1 small-bore piping butt welds. The One-time Inspection of ASME Code Class 1 Small-Bore Piping program will also include inspection of socket welds using a volumetric examination technique demonstrated to be capable of detecting cracking.

PNPP has been operating for more than 36 years at the time of the license renewal application submittal. According to the guidance of the GALL Revision 2, section XI.M35, the inspection sample size will include at least 3 percent of the population of program butt welds with a maximum of 10 program butt welds and at least 3 percent of the population of program socket welds with a maximum of 10 program socket welds.

Volumetric examinations will be performed using a demonstrated technique that is capable of detecting the aging effects in the examination volume of interest. For socket welds, the inspection will be either a volumetric or opportunistic destructive examination. If evidence of cracking is revealed by this one-time inspection, it will be entered into the Corrective Action Program to determine extent of condition, and a follow-up periodic plant-specific AMP will be implemented.

One-time inspections will be completed within the six year period prior to the period of extended operation and no later than six months prior to the period of extended operation.

A.1.37 OPEN-CYCLE COOLING WATER SYSTEM PROGRAM

The open-cycle cooling water (OOCW) systems program is an existing program that manages material loss due to micro- or macro-organisms and various corrosion mechanisms to ensure effective transfer of heat from safety-related structures, systems and components (SSCs) to the ultimate heat sink (UHS). At PNPP, raw water for heat transfer to safety-related SSCs is accomplished with the emergency service water (ESW) system. The program relies on the implementation of the recommendations of NRC Generic Letter (GL) 89-13 to ensure that the effects of aging on the OCCW systems will be managed for the period of extended operation. Other components are also managed under OCCW based on exposure to a raw water environment and the aging management review. In accordance with the guidance of GL 89-13, the OCCW program manages aging effects by using a combination of preventive, condition, and performance monitoring activities. These include (a) surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the OCCW system or structures and components serviced by the OCCW system; (b) inspection of critical components for signs of corrosion, erosion, and biofouling; and (c) testing of the heat transfer capability of heat exchangers that remove heat from components important to safety.

Loss of material due to recurring internal corrosion has been identified for the Emergency Service Water (ESW) System. Loss of material due to recurring internal corrosion and erosion is managed by augmented inspections utilizing the XI.M17 *Flow Accelerated Corrosion* program. The XI.S7, *RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants* aging management program is credited with silt removal from the from the multi-port intake structure through the ESW pumphouse, including intake and alternate intake tunnels, associated tunnel riser shafts, discharge tunnel, and discharge structure. AMP XI.M41, *Buried and Underground Piping and Tanks*, manages aging effects for underground ESW piping. These activities are not managed by this program.

The program will be continued for the period of extended operation.

A.1.38 PROTECTIVE COATING MONITORING AND MAINTENANCE PROGRAM

The Protective Coating Monitoring and Maintenance Program is an existing PNPP program that, with enhancements, is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.S8. The existing PNPP

Protective Coating Monitoring and Maintenance Program will be enhanced to comply with the requirements of ASTM D5163-08.

The failure of the Service Level I coatings could adversely affect the operation of the emergency core cooling systems (ECCS) by clogging the ECCS suction strainers.

The PNPP ECCS suction strainer is designed using the guidance in the Boiling Water Reactors Owners Group Utility Resolution Guidance (BWROG URG) document with a robust capacity for post-accident debris loading. Energy Harbor has also implemented foreign material exclusion (FME) procedures to limit the potential for clogging the ECCS suction strainer. Also, the ASME Section XI, Subsection IWE Program is credited for aging management of the containment and includes periodic visual examinations of the steel containment internal surfaces for signs of degradation, assessment of damage, and corrective actions. Acceptance criteria includes no gross flaking, peeling, or blistering of coatings, and no excessive debris accumulation.

Service Level I protective coatings for steel components are not credited for managing the aging effect of loss of material due to corrosion.

The program will be enhanced as follows:

1. The existing PNPP Protective Coating Monitoring and Maintenance Program will be enhanced to comply with the requirements of ASTM D5163-08.

The above enhancement will be implemented no later than six months prior to the period of extended operation.

A.1.39 REACTOR HEAD CLOSURE STUD BOLTING PROGRAM

The Reactor Head Closure Stud Bolting Program is an existing condition monitoring and preventive program that provides for ASME Section XI inspections of reactor head closure studs, nuts, flange threads and washers for cracking and loss of material.

The Reactor Heads Closure Studs Program examines reactor vessel stud assemblies in accordance with the examination and inspection requirements specified in the ASME B&PV Code, Section XI, Subsection IWB and approved ASME Code Cases. The extent and schedule for examining and testing the reactor head closure studs, nuts, flange threads, and washers is specified in Table IWB- 2500-1 for B-G-1 components, *Pressure Retaining Bolting Greater than 2 Inches in Diameter*. The flange threads and studs receive a volumetric examination, and the surfaces of nuts and washers are inspected using a VT-1 examination. All pressure-retaining boundary components in Examination Category B-P receive a visual VT-2 examination during the system pressure test.

In addition, the program includes the preventive measures to mitigate cracking described in the NUREG-1339, *Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*, and NRC Regulatory Guide 1.65, Revision 0, *Materials and Inspection for Reactor Vessel Closure Studs* with the exception that the PNPP stud assemblies are assumed to have an actual yield strength of greater than 150 ksi. There is no metal plating applied to the closure studs, nuts or washers. A phosphate coating is applied to threaded areas of the studs and nuts and bearing areas of the nuts and washers to act as a rust inhibitor and to assist in retaining lubricant (either graphite/alcohol or nickel powder base lubricant) on these surfaces. A stable lubricant that does not contain molybdenum disulfide is applied to the nuts, threads and all bearing surfaces of the nuts and washers prior to reactor vessel head re-installation.

The program will be enhanced as follows:

1. The purchasing requirements for reactor head closure stud material will be revised to assure that an studs procured in the future will have measured yield strength of less than 150 ksi.

This enhancement will be implemented no later than six months prior to the period of extended operation.

A.1.40 REACTOR VESSEL SURVEILLANCE PROGRAM

The Reactor Vessel Surveillance Program is an existing condition monitoring program that manages the loss of fracture toughness due to neutron irradiation embrittlement for reactor vessel beltline materials using material data and dosimetry. The program meets the requirements of 10 CFR 50, Appendix H.

The Reactor Vessel Surveillance Program is part of the BWRVIP Integrated Surveillance Program (ISP) described in BWRVIP-86, Revision 1-A and approved by the NRC. The schedule for removing surveillance capsules is in accordance with the timetable specified in BWRVIP-86, Revision 1-A. The PNPP 183° surveillance capsule, designated as an ISP(E) capsule, is scheduled for withdraw and testing in the period of extended operation at approximately 40 EFPY.

Surveillance capsule testing and reporting, to the extent practicable, is performed in accordance with the requirements of American Society for Testing and Materials (ASTM) E 185 Standard. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. Untested capsules placed in storage must be maintained for future insertion.

The program is a condition monitoring program that measures the increase in Charpy V-notch 30 foot-pound (ft-lb) transition temperature and the drop in the upper shelf energy as a function of neutron fluence and irradiation temperature. The data from this surveillance program are used to monitor neutron irradiation embrittlement and are used to support upper shelf energy and pressure-temperature limit calculations.

The program will be continued for the period of extended operation.

A.1.41 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power PlantsProgram

The RG 1.127, *Inspection of Water-Control Structures Associated with Nuclear Power Plants Program* is an existing condition monitoring program. The existing program consists of periodic inspections based on Regulatory Guide (RG) 1.127, Rev. 1 for the intake and discharge control structures, the associated intake and discharge tunnels, and other water-control structures associated with the emergency service water (ESW) system. Program inspections include concrete and steel structures and components associated with the ESW system, predominantly from the multi-port intake structure through the ESW pumphouse, including intake and alternate intake tunnels, associated tunnel riser shafts, sluice gates, screens, discharge tunnel, and discharge structure

The program will be enhanced as follows:

1. The scope of the program will be enhanced to manage aging effects associated with the ESW swale, and the flood mitigating features of the major stream, major stream culvert, remnant minor stream, and the diversion stream channel and diversion stream berm. The program implementing procedure will also include a listing of these earthen structures that are within the scope of license renewal. The program implementing procedure will also include a listing of existing procedures/instructions that are credited to manage the aging effects of water control structures that are within the scope of this aging management program. Parameters monitored will include settlement, depressions, sink holes, slope stability (e.g., irregularities in alignment and variances from originally constructed slopes), seepage, proper functioning of drainage systems, and degradation of slope protection features.

   The aging effects associated with concrete are loss of material, cracking, and various changes in material properties (that is, loss of bond, increase in porosity and permeability, reduction of strength, and differential settlement). The aging effects associated with earthen structures (rock, stone and soil) are loss of form and loss of material. The aging effects associated with wooden clamps supporting the electrical cables in manholes are change in material properties due to weathering, chemical degradation, insect infestation, repeated wetting and drying, fungal decay.

2. The program will be enhanced to include preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi)).

3. The program will be enhanced to include preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.

4. The program will be enhanced to include monitoring and inspection of the major stream culvert, and the flood mitigation features of the major stream, remnant minor stream, the diversion stream berm and channel, and the ESW swale. The program implementing procedure will also include a listing of these earthen structures that are within the scope of license renewal. The program implementing procedure will also include a listing of existing procedures/instructions that are credited to manage the aging effects of water control structures that are within the scope of this aging management program. Parameters monitored will include settlement, depressions, sink holes, slope stability (e.g., irregularities in alignment and variances from originally constructed slopes), seepage, proper functioning of drainage systems, and degradation of slope protection features.

5. Steel components are monitored for rust, erosion, corrosion, cavitation and weld cracks.

6. The program will be enhanced to include monitoring and inspection of earthen embankment structures associated with the major stream, remnant minor stream and the new diversion stream channel including the inline spillway structure at the outfall of the new channel.

   The berm inspections will include the following items:
   a) Identify if there are any wet areas, erosion, or slides
   b) Identify if there are obstructions in the stream that could partially block or prevent flow
   c) Identify bare spots needing re-vegetation
   d) Locate any riprap or erosion protection that has been displaced
   e) Identify cracks that may indicate potential excessive settlement (>1 foot) or slope instability
   f) Identify any burrowing rodent holes that could impact the performance or stability of the berm

These enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.42 SELECTIVE LEACHING PROGRAM

The Selective Leaching Program is a new program that will demonstrate the absence of selective leaching. The program for selective leaching of materials will ensure the integrity of the components made of ductile iron, gray cast iron and copper alloys (except for inhibited brass) that contain greater than 15 percent zinc (> 15% Zn) exposed to a water environment (e.g., raw water, treated water, soil, etc.) that may lead to selective leaching of one of the metal components. There are no aluminum bronze in-scope components with greater than eight percent aluminum.

The program will include a one-time visual inspection coupled with either hardness measurement or other mechanical examination techniques such as destructive testing (when the opportunity arises), scraping, or chipping of selected components that may be susceptible to selective leaching. Follow-up of unacceptable inspection findings will include an evaluation using the corrective action program and a possible expansion of the inspection sample size and location.

Inspections will include a representative sample of the system population and will focus on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. A representative sample size will be 20% of the population (defined as components having the same material and environment combination) with a maximum of 25 components. Otherwise, a technical justification of the methodology and sample size used for selecting components for one-time inspection will be included as part of the program's documentation.

Those ductile iron and gray cast iron buried components which (a) have been cathodically protected since installation, (b) the cathodic protection system has had 80 percent availability for the last 10 year period prior to the period of extended operation, and (c) the as-found pipe-to-soil potential readings during periodic cathodic protection surveys meet the “acceptance criteria” program element of AMP XI.M41 do not require selective leaching inspections.

Underground components which have their external surfaces coated in accordance with Table XI.41-1 of AMP XI.41, and where visual examinations of in-scope buried piping has not revealed any coating damage, do not require selective leaching inspections. A single instance of through-wall coating damage to underground cast iron pipe with confirmed evidence of leaching (not in-scope piping) has occurred at PNPP. Because the operating experience is a single instance, the inspection sample size for coated underground cast iron pipe may be reduced to 5 percent of the population with a maximum of six components.

The acceptance criteria will consist of no visible evidence of selective leaching or no more than a 20 percent decrease in hardness. For copper alloys >15% Zn, the criteria will be no noticeable change in color from the normal yellow color to the reddish copper color.

The Selective Leaching Program one-time visual inspection will be conducted within 5 years of, and no later than six months prior to, the period of extended operation.

A.1.43 STRUCTURES MONITORING PROGRAM

The Structures Monitoring Program is an existing condition monitoring program that manages the effects of aging on structures and structural components within the scope of license renewal. The program was developed based on guidance in Regulatory Guide 1.160 Revision 2, *Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*, and NUMARC 93-01 Revision 2, *Industry Guidelines for Monitoring the Effectiveness of*

Maintenance at Nuclear Power Plants, to satisfy the requirement of 10 CFR 50.65, *Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.*

The scope of the Structures Monitoring Program includes structures, structural components, component supports, and structural commodities in the scope of license renewal that are not covered by other structural aging management programs (AMPs) (i.e., *ASME Section XI, Subsection IWE* (AMP XI.S1); *ASME Section XI, Subsection IWL* (AMP XI.S2); ASME Section XI, *Subsection IWF* (AMP XI.S3); and *RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants* (AMP XI.S7)). The scope of Structures Monitoring Program also includes the in scope (non-safety/non-seismic) masonry walls as described in AMP.XI.S5.

Aging effects associated with the in-scope masonry walls are managed by this structures monitoring program as described in the Masonry Walls Aging Management Program Description. There are no safety related masonry walls that are in close proximity to or having attachments from safety-related systems or components, as such PNPP does not have any safety related masonry walls meeting the criteria of I.E Bulletin 80-11 or IN 87-67. The masonry walls that are within the scope of license renewal at PNPP are limited to isolated non-safety related, non-seismic Category I structures. The program consists of periodic inspection and monitoring of the conditions of structures and structural components to ensure that aging degradation leading to loss of intended functions will be detected and that the extent of degradation can be determined. Unacceptable conditions, when found, are evaluated or corrected in accordance with the corrective action program.

Protective coatings are not relied upon to manage the effects of aging for structures included in the scope of this program.

The program will be enhanced as follows:

1. The program implementing procedure will be enhanced to include a listing of Unit 1 and Unit 2 structures and structural bulk commodities within the scope of license renewal that credit the Structures Monitoring Program for aging management.

2. The program implementing procedure will list the current procedures/instructions that combine to manage the aging effects of the structural elements that are within the scope of the structures monitoring program as part of aging management for license renewal.

3. The program will be enhanced to monitor the structural integrity of the plant underdrain system including the porous concrete sub-foundations.
4. The program will be enhanced to monitor ground water chemistry including accounting for seasonal variations.
5. The program will be enhanced to monitor the loss of material and flow blockage in the plant storm drain piping.
6. The program will be enhanced to inspect the in-scope non-safety related/non-seismic masonry walls for loss of material (spalling, scaling), change in material properties and cracking due to freeze-thaw.

7. The program will be enhanced to include preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 ksi).

8. The program will be enhanced to include preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.

9. The program will be enhanced to monitor the structural integrity of the plant underdrain system including the porous concrete sub-foundations. The program elements would include:

   - the plant underdrain system maintenance and inspection
   - monitoring for building settlement,
   - monitoring the groundwater elevation.

10. The program will be enhanced to monitor ground water chemistry on a frequency of at least once every five years including accounting for seasonal variations for pH, chlorides, and sulfates and verify that it remains non-aggressive, or evaluate results exceeding criteria to assess impact, if any, on below-grade concrete.

11. The program will be enhanced to require that structures and structural components are monitored on a frequency not to exceed 5 years.

12. The program will be enhanced to specify that a representative sample of high strength (actual measured yield strength ≥ 150 ksi or 1,034 MPa) structural bolts greater than 1 inch (25 mm) in diameter are monitored for SCC at least once every 10 years.

13. The program will be enhanced to monitor accessible sliding surfaces to detect significant loss of material due to wear, corrosion, debris, dirt, distortion, or overload that could restrict or prevent sliding of surfaces as required by design.

14. The program will be enhanced to require inspection of elastomeric components for cracking, loss of material and hardening. Visual inspections of elastomeric components are to be supplemented by feel or manipulation to detect hardening. Include instructions to enhance the visual examination of elastomeric material with physical manipulation of at least ten percent of available surface area.

15. The program will be enhanced to require (a) evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas and (b) examination of representative samples of the exposed portions of the below grade concrete, when excavated for any reason. If normally inaccessible areas become accessible due to planned activities, an inspection of these areas shall be conducted.

16. The program will be enhanced to require the plant storm drain piping to be monitored for:

    - Unacceptable flow blockage
    - Observed structural degradation

    This monitoring will consist of direct observation (storm drain grating flow and blockage) and periodic remote visual inspections of sampled portions of storm drain system piping. Additionally, the site's implementing document will include required inspections following offsite agency confirmation that an earthquake has occurred in the area of the plant for any sign of ground settlement that could be an indication of storm drain piping collapse to assure the integrity of the piping.

17. Perform special inspections of the storm drain system immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls.

18. Plant procedures will be enhanced to prescribe quantitative acceptance criteria based on the acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11 and relevant AISC specifications. Industry and plant specific operating experience will also be considered in the development of the acceptance criteria.

19. Loose bolts and nuts and cracked high strength bolts will not be acceptable unless accepted by engineering evaluation.

20. Structural sealants will be acceptable if the observed loss of material, cracking, and hardening will not result is loss of sealing.

21. Elastomeric vibration isolation elements will be acceptable if there is no loss of material, cracking, or hardening that could lead to the reduction or loss of isolation function.

22. Acceptance criteria for sliding surfaces will be (a) no indications of excessive loss of material due to corrosion or wear and (b) no debris or dirt that could restrict or prevent sliding of the surfaces as required by design.

23. Acceptance criteria for high strength structural bolting shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section V, Article 5, Appendix IV.

24. The program will be enhanced to require that personnel performing inspections and evaluations meet the qualifications specified within ACI Report 349.3R with respect to knowledge of inservice inspection of concrete and visual acuity requirements.

25. Unimpregnated and impregnated (with elastomer) fiber glass fabric will be monitored for cracking, delaminating and visible deterioration.

These enhancements will be implemented no later than six months prior to the period of extended operation.

A.1.44 WATER CHEMISTRY PROGRAM

The Water Chemistry Program is an existing prevention and mitigation program whose activities mitigate the loss of material due to corrosion, cracking due to stress corrosion cracking (SCC) and reduction of heat transfer in components exposed to a treated water environment. The program includes periodic monitoring and control of water chemistry to keep peak levels of various contaminants below the system-specific limits based on Electric Power Research Institute (EPRI) guideline BWRVIP-190, (EPRI 3002002623, *BWR Water Chemistry Guideline, Revision 1, 2019 Interim Guidance*) for BWRs.

The One-Time Inspection Program will be used to verify the effectiveness of the Water Chemistry Program.

The program will be continued for the period of extended operation.

A.2 EVALUATION SUMMARIES OF TIME LIMITED AGING ANALYSES

In accordance with 10 CFR 54.21(c), an application for a renewed operating license requires an evaluation of time-limited aging analyses (TLAAs) for the period of extended operation. The following TLAAs have been identified and evaluated to meet this requirement.

A.2.1 INTRODUCTION

As part of the application for a renewed license, 10 CFR 54.21(c) requires that an evaluation of Time-Limited Aging Analyses (TLAAs) for the period of extended operation be provided. The TLAAs identified and evaluated to meet these requirements are described below.

10 CFR 54.21(c)(2) also requires that the application for a renewed license include a list of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based upon TLAAs as defined in 10 CFR 54.3. It also requires an evaluation that justifies the continuation of these exemptions for the period of extended operation. No exemptions were identified that are based upon a TLAA. Therefore, no further evaluation is required.

A.2.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT ANALYSES

10 CFR 50.60 requires that all light-water reactors meet the fracture toughness, P-T limits, and material surveillance program requirements for the reactor coolant pressure boundary as set forth in 10 CFR 50 Appendices G and H. The current reactor pressure vessel embrittlement calculations for PNPP that evaluate reduction of fracture toughness of the reactor pressure vessel beltline materials for 40 years are based upon a predicted end-of-license fluence applicable for 32 Effective Full Power Years (EFPY). These analyses were identified as TLAAs as defined in 10 CFR 54.21(c) and were re-evaluated for the increased neutron fluence associated with 60 years of operation as described in the subsections below.

A.2.2.1 NEUTRON FLUENCE

Fluence projections were performed to predict the neutron fluence expected to occur during 32 EFPY, which exceeded the predicted EFPY for 40 years of plant operation. These fluence projections have been identified as TLAAs requiring evaluation for the period of extended operation.

Reactor pressure vessel (RPV) plates, welds and nozzles that receive a fluence value that exceeds the threshold value of 1.0E+17 n/cm^2 for 54 EFPY define the RPV beltline for the period of extended operation. Neutron fluence analyses valid for 54 EFPY, which bounds the projected EFPY value for 60-years of operation, have been prepared for the RPV beltline materials.

The neutron fluence analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.2.2 UPPER SHELF ENERGY

The current licensing basis Charpy upper shelf energy (USE) calculations were prepared for the PNPP reactor vessel beltline materials for 32 EFPY. These USE calculations have been identified as TLAAs requiring evaluation for 60 years.

The 54 EFPY USE values for the reactor vessel the beltline and extended beltline materials have been evaluated and are projected to remain above the 50 ft-lb minimum requirement through the period of extended operation. The USE analyses have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.2.3 ADJUSTED REFERENCE TEMPERATURE ANALYSES

10 CFR 50, Appendix G, defines the fracture toughness requirements for the life of the vessel. The shift in the initial RTNDT (ΔRTNDT) is evaluated as the difference in the 30 ft-lb index temperatures from the average Charpy curves measured before and after irradiation. This increase (ΔRTNDT) determines how much higher the vessel temperature must be raised for the material to continue to act in a ductile manner. The ART is defined as: Initial RTNDT + ΔRTNDT + Margin. Since the ΔRTNDT value is a function of 32 EFPY fluence in the current ART calculations associated with the 40-year licensed operating period, these ART evaluations are TLAAs requiring evaluation for 60 years.

54 EFPY ART values have been evaluated and are projected to remain within the acceptable limits through the period of extended operation. The ART analyses have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.2.4 PRESSURE TEMPERATURE (P-T) LIMITS

10 CFR 50, Appendix G, defines the fracture toughness requirements for the life of the vessel. The shift in the initial RT_{NDT} (ΔRT_{NDT}) is evaluated as the difference in the 30 ft-lb index temperatures from the average Charpy curves measured before and after

irradiation. This increase (ΔRT_{NDT}) determines how much higher the vessel temperature must be raised for the material to continue to act in a ductile manner. The ART is defined as: Initial RT_{NDT} + ΔRT_{NDT} + Margin. Since the ΔRT_{NDT} value is a function of 32 EFPY fluence in the current ART calculations associated with the 40-year licensed operating period, these ART evaluations are TLAAs requiring evaluation for 60 years.

54 EFPY ART values have been evaluated and are projected to remain within the acceptable limits through the period of extended operation. The ART analyses have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.2.5 RPV Shell Welds Failure Probability Assessment Analyses

BWRVIP-05 and BWRVIP-74-A provide evaluations to determine the probability of failure (POF) of the RPV beltline axial and circumferential welds and provide the RPV inspection requirements. PNPP has followed the guidance provided in these BWRVIP documents.

BWRVIP-329-A evaluated the application of latest computer techniques to identify the limiting combinations of the limiting maximum reference temperatures for plates and axial and circumferential welds that ensure total through-wall cracking frequency remains below the acceptance criteria. PNPP has evaluated the applicable reactor vessel parameters against the requirements of BWRVIP-329-A and determined that the BWVIP evaluations for 54 EFPY bound the PNPP reactor vessel.

The RPV shell welds failure probability assessment analyses have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.2.6 RPV Reflood Thermal Shock

10 CFR 50 Appendix A, General Design Criterion (GDC) 31, requires that the reactor coolant pressure boundary (RCPB) of a light water reactor (LWR) be designed such that it possesses adequate margin against non-ductile failure for all postulated conditions. For General Electric (GE) designed Boiling Water Reactors (BWRs) this requirement has been demonstrated through development of Pressure-Temperature Limit Curves (P-T curves) and reference to generic analyses, which address the limiting Loss of Coolant Accident (LOCA) event. Since the initial RPV reflood thermal shock analyses are based upon fluence values associated with 40 years of operation, they have been identified as TLAAs requiring evaluation for the period of extended operation.

An updated PNPP RPV reflood thermal shock analysis has been performed which considered plant operation through the period of extended operation. The analysis demonstrates that adequate margin against non-ductile failure of the PNPP RPV exists as required by 10 CFR 50, Appendix A, GDC 31.

The RPV reflood thermal shock analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.3 METAL FATIGUE

Metal fatigue was considered explicitly in the design process for pressure boundary components designed in accordance with ASME Section III, Class A or Class 1 requirements. Metal fatigue was evaluated implicitly for components designed in accordance with ASME Section III, Class 2 or 3 requirements or ANSI B31.1 requirements. Each of these fatigue analyses and evaluations are considered to be Time-Limited Aging Analyses requiring evaluation for the period of extended operation in accordance with 10 CFR 54.21(c) as described below.

A.2.3.1 CLASS 1 FATIGUE

The PNPP RPV and reactor coolant pressure boundary (RCPB) piping and components were designed in accordance with the ASME Code Section III, Class 1 design requirements. Fatigue analyses were prepared for these components to determine the effects of cyclic loadings resulting from changes in system temperature and pressure and for seismic loading cycles. The calculation of fatigue usage was based on the projected transient occurrences for the 40-year life of the plant. These Class 1 fatigue analyses have been identified as Time-Limited Aging Analyses (TLAAs) requiring evaluation for the period of extended operation.

The design plant transients have been projected to 60 years of operation. The cumulative usage factors for the ASME Class 1 components have been evaluated through the period of extended operation and shown to meet the ASME fatigue requirements. The component cumulative usage factors will be re-evaluated based on actual plant transients to verify that the components remain within the ASME fatigue requirements through the period of extended operation.

The effects of fatigue on the intended functions of components analyzed in accordance with ASME Class 1 requirements will be managed for the period of extended operation.

<u>Reactor Pressure Vessel</u>

The RPV is designed, fabricated, tested, inspected, and stamped in accordance with the ASME Code Section III, Class I requirements including the addenda in effect at the date of order placement, Winter 1972. Fatigue analyses were prepared for the RPV based the 40-year transient projections. The RPV fatigue analyses are considered to be a TLAA requiring evaluation for the period of extended operation.

The effects of fatigue on the RPV will be managed for the period of extended operation.

Class 1 Piping

The Class 1 piping systems were designed to the requirements of Section III of the ASME Boiler and Pressure Vessel Code. Detailed fatigue analyses were performed for all the Class 1 portions of the piping systems based on the 40-year transient projections.

The effects of fatigue on the Class 1 piping will be managed for the period of extended operation.

The effects of fatigue on the RPV and RCPB piping and components will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.3.2 NON-CLASS 1 FATIGUE

Piping designed in accordance with ASME Section III, Class 2 or 3 or ANSI B31.1 Piping Code is not required to have an explicit analysis of cumulative fatigue usage, but cyclic loading is considered in a simplified manner in the design process. These codes first require prediction of the overall number of thermal and pressure cycles expected during the 40-year lifetime of these components. Then a stress range reduction factor is determined for the predicted number of cycles. If the total number of cycles does not exceed the specified limit, the stress range reduction factor of 1.0 is applied, which would not reduce the allowable stress value. These are considered to be implicit fatigue analyses since they are based upon cycles anticipated for the life of the component and are therefore, TLAAs requiring evaluation for the period of extended operation.

The transient cycles for the non-Class 1 systems have been evaluated and determined that the specified cycle limits would not be exceeded for 60 years of operation.

The non-class 1 piping stress analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.3.3 ENVIRONMENTAL FATIGUE

NUREG-1800, Revision 2, provides a recommendation for evaluating the effects of the reactor water environment on the fatigue life of ASME Section III Class 1 components that contact reactor coolant. One method acceptable to the staff for satisfying this recommendation is to assess the impact of the reactor coolant environment on a sample of critical components. These critical components should include those selected in NUREG/CR-6260 applicable to the plant. Consideration should also be given to adding additional component locations if they are more limiting than those considered in NUREG/CR-6260.

Environmental fatigue calculations were performed for component locations listed in NUREG/CR-6260 for the newer-vintage BWR. Similar to the evaluations performed in NUREG/CR-6260, the locations of highest design cumulative usage factors (CUFs) were evaluated to determine other locations that may not be bounded by the NUREG/CR-6260 locations. In determining the environmental fatigue multipliers (F_{en}) for the different component materials, the overall percentage of time the plant will have operated within each of the PNPP water chemistry regimes by the end of the period of extended operation was determined based upon a review of plant chemistry records.

Using the resulting location-specific bounding F_{en} values and bounding CUF values, the environmental fatigue was determined using the fatigue curves specified in NUREG/CR 6909, Tables A.1 and A.2. Section A.2.1 of NUREG/CR-6909, Revision 1 allows for the use of the average temperature (i.e., average of the maximum temperature for the transient and the higher of the threshold temperature for the material under consideration and the minimum temperature for the transient) for simple transients in cases of constant strain rate and linear temperature response.

The Fatigue Monitoring Program calculates cumulative usage factors (CUFs) for the limiting locations and requires corrective actions if design limits are approached. This is accomplished using cycle-based fatigue (CBF) monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0, including environmental effects where applicable.

The effects of environmental fatigue on the intended functions of the Reactor Coolant Pressure Boundary (RCPB) components will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii)

A.2.3.4 REACTOR VESSEL INTERNALS FATIGUE

The reactor vessel internals consist of the core support structure and non-core support structure components. The core support structure components are designed in accordance with ASME Code, Section III, Subsection NG. As a result, detailed fatigue analyses were performed for the core support structure components based on the project 40-year plant transient projects and are TLAAs requiring evaluation for the period of extended operation.

The CUFs for the core support structures have been evaluated based on the 60-year plant transient projects and have been determined to meet the ASME fatigue requirements. The CUFs will be re-evaluated based on actual plant transients to verify that the components remain within the ASME fatigue requirements through the period of extended operation.

The effects of fatigue on the core support structure components will be managed for the period of extended operation by the Fatigue Monitoring Program and BWR Reactor Vessel Internals Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.3.5 INTERMEDIATE HELB LOCATION DETERMINATION

UFSAR Section 3.6.2.1.5 indicates that the determination of intermediate high energy line break (HELB) locations for Class 1 piping relied on an evaluation of cumulative usage factors (CUFs). As long as other stress criteria were also met, a break is not postulated at a location if the CUF is less than 0.1. Usage factors, as calculated in the design fatigue analyses, account for the design transients assumed for the original 40-year life of the plant. The analysis of cumulative usage factors used in the selection of postulated high energy line break locations is considered a TLAA.

The CUFs for the HELB locations for Class 1 piping have been evaluated based on the 60-year plant transient projects and have been determined to meet the ASME fatigue requirements. The CUFs will be re-evaluated based on actual plant transients to verify that the components remain within the ASME fatigue requirements through the period of extended operation.

The effects of fatigue on the HELB locations for Class 1 piping will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.4 ENVIRONMENTAL QUALIFICATION FOR ELECTRICAL EQUIPMENT

The PNPP Environmental Qualification (EQ) of Electrical Components Program manages component thermal, radiation, and cyclical aging using aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered analyses (TLAAs) for license renewal..

Reanalysis of an aging evaluation to extend the qualification of components under 10 CFR 50.49(e) is performed on a routine basis as part of the PNPP EQ of Electrical Components Program. Important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met).

Environmental qualification of electrical equipment will be managed for the period of extended operation by the EQ of Electrical Components Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.5 CONTAINMENT LINER PLATE, METAL CONTAINMENTS, AND PENETRATIONS FATIGUE ANALYSIS

A.2.5.1 CONTAINMENT VESSEL

The containment vessel is a pressure retaining structure composed of a free standing steel cylinder with an ellipsoidal dome, secured to a steel-lined, reinforced concrete foundation mat. The free-standing portion of the containment vessel is supported by and anchored into the foundation mat, and is designed, fabricated, and erected in accordance with the requirements of ASME Code Section III for Class MC components. As a result, a detailed fatigue analysis was performed for the PNPP containment vessel, which is considered to be a TLAA.

The CUF for the containment vessel limiting location has been evaluated based on the 60-year plant transient projects and has been determined to meet the ASME fatigue requirements. The CUF will be re-evaluated based on actual plant transients to verify that the components remain within the ASME fatigue requirements through the period of extended operation.

The effects of fatigue on the containment vessel will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.5.2 CONTAINMENT PIPING PENETRATIONS

The containment penetrations are designed in accordance with the requirements of Section III of the ASME Boiler and Pressure Vessel Code. As a result, detailed fatigue analyses were performed for the containment penetration assemblies, which are considered to be a TLAA.

The CUFs for the bounding containment penetrations have been evaluated based on the 60-year plant transient projects and have been determined to meet the ASME fatigue requirements. The CUFs will be re-evaluated based on actual plant transients to verify that the components remain within the ASME fatigue requirements through the period of extended operation.

The effects of fatigue on the containment penetrations will be managed for the period of extended operation by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.5.3 CONTAINMENT PIPING PENETRATIONS BELLOWS

Guard pipe assemblies associated with containment penetrations utilize bellows. The PNPP specification required these bellows to be analyzed for at least 500 cycles of normal operation plus one safe shutdown earthquake (SSE) cycle for 40 years of operation. Therefore, these fatigue analyses are identified as TLAAs requiring disposition for license renewal.

The bellows are qualified for more than the 60-year projected number of startups and shutdowns.

The bellows analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.6 PLANT SPECIFIC TLAAS

A.2.6.1 CRANE LOAD CYCLES

The following PNPP cranes are credited in the response to NUREG-0612 "Control of Heavy Loads at Nuclear Power Plants”

- Reactor Building Crane (a.k.a., Containment Polar Crane)
- Fuel Handling Building Crane
- Emergency Service Water Pump House Crane

These cranes are designed to the requirements of Crane Manufacturers Association of America (CMAA) Specification 70 (1975) for Class A service. Cranes designated Class A service level are designed for 20,000 to 100,000 cycles. This evaluation of cycles over the 40-year plant life is the basis of a safety determination and has been identified as a TLAA that requires evaluation for 60 years.

The number of cranes lift cycles was projected to 60-years of operations. The number of projected lifts for each of the cranes was well below the 20,000 cycles for which the cranes were qualified.

Crane load cycle assumptions remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.6.2 MAIN STEAM LINE FLOW RESTRICTORS EROSION ANALYSIS

A main steam line flow restrictor is welded into each of the four main steam lines between the main steam relief valves and the inboard main steam isolation valve (MSIV). The restrictor assemblies consist of a stainless steel venturi-type nozzle welded into the carbon steel main steam line piping. UFSAR Section 5.4.4 indicates that only very slow erosion will occur with time and that such a slight enlargement will have no safety significance. The erosion analysis of the main steam line flow restrictor was based on 40 years of operation and has been identified as a TLAA that requires evaluation for the period of extended operation.

The main steam line break accident analysis assumed the flow in each steam line was limited by critical flow at the restrictor to a maximum of 200 percent of rated flow for each line. Calculations indicate that even with erosion rates as high as 0.004 inches per year, after 40 years of operation the increase in choked flow rate would be no more than 5 percent. Even if the choked flow rate is increased 8 percent to account for the additional 20 years of service, the resulting mass flow rate is substantially less than 200 percent of rated flow assumed in the UFSAR main steam line break accident analysis.

The analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.6.3 REDUCTION OF FRACTURE TOUGHNESS FOR THE REACTOR VESSEL INTERNALS

The GE design specification for the PNPP core support structure (CSS) components of the reactor vessel internals includes requirements beyond the ASME design requirements for austenitic stainless steel components exposed to a fluence of greater than 1.0E+21 n/cm^2 for base metal and 5.0E+20 n/cm^2 for welds.

The neutron fluence thresholds for the CSS components of the reactor vessel internals in the GE design specification were developed for a design life of 40 years, therefore, this is considered a time-limited aging analysis requiring disposition for license renewal.

The BWRVIP program has developed substantially greater data and operating experience than existed at the time the GE design specification was prepared. Further, the BWRVIP program is credited by all U.S. BWRs to ensure management of the aging effects applicable to the CSS components.

The reduction of fracture toughness for the reactor vessel internals will be managed for the period of extended operation by the BWR Vessel Internals Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.6.4 Fatigue Analysis – Earthquake Cyclic Loading

UFSAR Section 3.7.3.2 identifies the design basis for earthquake cycles over the 40-year life of the plant used as input to the fatigue analyses for different classes of piping and components, which are considered to be a TLAA.

PNPP has experienced one operating basis earthquake (OBE) on January 31, 1986.

The assumptions related to the number of earthquakes cycles used as input to the fatigue analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.6.5 Fatigue Due to Partial Feedwater Heating

Operation with partial feedwater heating (PFH), which is described in UFSAR Appendix 15D, occurs in the event that (1) certain stage(s) or string(s) or an individual heater becomes inoperable, or (2) intentionally valving out the extraction steam to the feedwater heaters at the end of an operating cycle. The effect of PFH on the acoustic and flow induced loads on the reactor shroud, shroud support and jet pumps were re-investigated to ensure that design limits are not exceeded. The evaluation of the cumulative usage factors for the feedwater nozzle and the sparger were evaluated in detail and remained below the ASME requirements for the 40-year life of the plant, which is considered to be a TLAA.

The fatigue usage for the feedwater nozzle has been re-evaluated for the period of extended operation and the CUF meets the ASME requirement. The sparger is not in scope for license renewal because it does not perform a license renewal intended function, its failure does not result in consequential failure of any safety-related equipment including the potential effects of loose parts, and it is not credited for any regulated events.

The effects of PFH operation will be managed for the period of extended operation by the BWR Feedwater Nozzle Program. in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.6.6 Fatigue Due to Single Recirculation Loop Operation

UFSAR Appendix 15F discusses single loop operation (SLO) and justifies that PNPP can safely operate with a SLO up to approximately 70% of rated thermal power. As part of the evaluation of SLO, the fatigue on the reactor vessel internals due to vibratory loading was evaluated. The evaluation showed that all internals components, except the in-core guide tubes, had adequate fatigue life without detailed analysis.

As provided in the UFSAR, the available CUF for the in-core guide tubes resulting from SLO operation was projected for 40 years of operation and determined that there was enough available CUF for PNPP could operate in SLO for several years. This evaluation is a TLAA.

The available CUF for the in-core guide tubes resulting from SLO operation was projected for 60 years of operation and determined that there still adequate available CUF for PNPP could operate in SLO for several years. As of March 1, 2023, PNPP has operated in SLO approximately 80 days, well within the evaluated allowable operating time.

The evaluation of the cumulative usage factor for the in-core guide tubes in SLO has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.6.7 STEAM PIPING EROSION

PNPP submitted a comprehensive study, "Steam Erosion Hazards Analysis," to verify that safe shutdown of the plant could be assured if a steam erosion-related break were to occur. The study concluded that the effects of steam erosion could not prevent safe shutdown for the 40 year life of the plant. In the response to an NRC request for additional information, PNPP identified that the piping potentially impacted by steam erosion is included in the Inservice Inspection Program. This analysis is considered to be a TLAA.

Based on the review of the "Steam Erosion Hazards Analysis" by the NRC, PNPP committed to monitoring the extraction steam (N36), high pressure and low pressure heater drains and vents (N25/26), and main, reheat, extraction, and miscellaneous drains (N22) systems via the Inservice Inspection Program to mitigate/detect any effects of steam erosion.

The extraction steam and the high pressure and low pressure heater drains and vents systems are not in scope for license renewal as they do not perform a license renewal intended function, their failure would not result in failure of a safety-related function, and they are not credited for any regulated events.

The main, reheat, extraction, and miscellaneous drains system is in scope for license renewal. The effects of steam erosion for piping in this system will be monitored by the Flow Accelerated Corrosion Program.

The effects of steam piping erosion will be managed for the period of extended operation by the Flow Accelerated Corrosion Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.6.8 SILICONE SEALANT IN ENGINEERED SAFETY FEATURES (ESF) HVAC DUCTWORK

Silicone sealants are used in the ESF HVAC ductwork on a limited basis. PNPP performed a qualification program to demonstrate the capability of the sealant to perform its intended function for the 40 year life of the plant. PNPP committed to perform routine monitoring of the applicable ESF ductwork and a sample of a ductwork/sealant combination. The qualification of this silicon sealant for use in the ESF ductwork is considered to be a TLAA.

PNPP committed to a monitoring program for the applicable ESF ductwork and a sample of the ductwork/sealant combination. The commitment for this monitoring program will be extended into the period of extended operation and will be managed by the External Surfaces Monitoring of Mechanical Components Program.

The aging effects of silicone sealant used in ESF HVAC ductwork will be managed for the period of extended operation by the External Surfaces Monitoring of Mechanical Components Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.6.9 TOP GUIDE GRID BEAM NEUTRON FLUENCE

The evaluation of the fracture toughness of the reactor vessel is valid for the top guide grid beam. The neutron fluence thresholds of the design specification were based on a design life of 40 years. The evaluation of the fracture toughness of the top guide grid beam is considered a TLAA.

The top guide grid beam is a component included in the BWR Vessel Internals Program. BWRVIP-26 specifically addressed the effects of neutron fluence on this component and provided the results of a component-specific calculation to determine 60-year accumulated neutron fluence.

The reduction of fracture toughness for the top guide grid beam will be managed for the period of extended operation by the BWR Vessel Internals Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.6.10 JET PUMP FATIGUE ANALYSIS

The evaluation of the fracture toughness of the reactor vessel internals is valid for the jet pump components. The neutron fluence thresholds of the design specification were based on a design life of 40 years. The susceptibility of the jet pump components to fatigue is considered to be a TLAA.

BWRVIP-41 specifically addressed the effects loss of fracture toughness for the jet pump components and identified the susceptibility of these components to fatigue. The jet pump components are susceptible to two sources of fatigue -- system cycling fatigue and vibration fatigue.

The loss of fracture toughness for the jet pump components will be managed for the period of extended operation by the BWR Vessel Internals Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.6.11 Allowable Stress Analysis of BOP ASME Code Class 1, 2 and 3 Components

The balance of plant systems and components are identified in accordance with ASME Code Class and Safety Class. The design limits and load for the ASME Code Class 1, 2 and 3 systems are provided in UFSAR Tables 3.9-18 through 3.9-21a. The stress calculations based on these limits are considered to be a TLAA.

The stress limits for BOP ASME Code Class 1, 2 and 3 components were determined based on the applicable portions of the ASME Code. Though the design requirements of the Code are somewhat affected by the assumed 40 year plant lifetime, these stress limits will remain applicable for the period of extended operation.

The allowable stress for the BOP ASME Code Class 1, 2 and 3 components remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.6.12 RV Annealing

In-place annealing of the reactor vessel was evaluated and determined to be unnecessary because shifts in transition temperature caused by irradiation during the 40-year life could be accommodated. The evaluation of the need for in-place annealing is considered to be a TLAA.

The effects of neutron fluence on the reactor vessel have been evaluated, which indicate that shifts in transition temperature can be accommodated during the period of extended operation.

The determination that in-place annealing of the reactor vessel is not necessary remains valid for the period of extended operation Program in accordance with 10 CFR 54.21(c)(1)(i).

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
1	XI.S4	Continue the existing 10 CFR 50, Appendix J Program	Ongoing	A.1.1 B.2.1
2	XI.M29	Implement the new Aboveground Metallic Tanks Program	May 8, 2026	A.1.2 B.2.2
3	XI.M1	Continue the existing ASME Section XI InserviceInspection, Subsections IWB, IWC, and IWD Program	Ongoing	A.1.3 B.2.3
4	XI.S1	Continue the existing ASME Section XI, Subsection IWE Program	Ongoing	A.1.4 B.2.4
5	XI.S3	Complete the following enhancements to the existing ASME Section XI, Subsection IWF Program: 1. The program will be enhanced to include preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi)). 2. The program will be enhanced to include preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.	May 8, 2026	A.1.5 B.2.5

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
5 (Cont.)	XI.S3	3. The program will be enhanced to specify that, in addition to VT-3 examination, high strength bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch nominal diameter, shall receive a volumetric examination in accordance with the requirements of ASME Code Section V, Article 5, Appendix IV. The representative sample size will be equal to 20 percent (rounded up to the nearest whole number) of the entire IWF population (for a given ASTM specification) of high strength bolts in sizes greater than 1 inch nominal diameter, with a maximum sample size of 25 bolts. The selection of the representative sample will consider susceptibility to stress corrosion cracking (e.g., actual measured yield strength) and ALARA principles. The frequency of examination will be once each 10-year ISI Interval. 4. The program will be enhanced to revise plant procedures to specify the following conditions as unacceptable: • Loss of material due to corrosion or wear that reduces the load bearing capacity of the component support. • Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support. • Cracked or sheared bolts, including high strength bolts, and anchors.		

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
6	XI.S2	Complete the following enhancements to the existing ASME Section XI, Subsection IWL Program: 1. Areas of concrete deterioration and distress will be recorded in accordance with the guidance provided in ACI 349.3R. 2. The acceptance criteria will be based on ACI 349.3R for identification of concrete degradation. Quantitative acceptance criteria based on the "Evaluation Criteria" provided in Chapter 5 of ACI 349.3R will be used to augment the qualitative assessment of the Responsible Engineer.	May 8, 2026	A.1.6 B.2.6
7	XI.M18	Complete the following enhancements to the existing Bolting Integrity Program: 1. High strength bolting (regardless of code classification) will be monitored for cracking in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-G-1. 2. Perform visual inspection of submerged bolting for the Emergency Service Water pumps, diesel and motor fire pumps, emergency service water screen wash pumps and Spent Fuel Rack Grid Structure for loss of material and loss of preload on a 10 year frequency.	May 8, 2026	A.1.7 B.2.7

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
7 (Cont.)	XI.M18	**3.** Perform visual inspection of submerged bolting for the Emergency Core Cooling Systems (ECCS) and Reactor Core Isolation Cooling (RCIC) system suction strainer in the suppression pool for loss of material and loss of preload (loose or missing nuts and bolts) on a 10 year frequency. 4. Acceptance criteria for high strength structural bolting shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section V, Article 5, Appendix IV. **5.** Preventive measures will include using bolting material that has an actual measured yield strength limited to less than 1,034 megapascals (MPa) (150 kilo-pounds per square inch [ksi]).		
8	XI.M41	Complete the following enhancements to the existing Buried and Underground Piping and Tanks Program: 1. Site procedures will be enhanced to: • Identify the systems containing buried or underground piping within the scope of license renewal. • Describe opportunistic inspections. • Describe cathodic protection. • Describe fire jockey pump monitoring. • Describe the directed underground and buried inspections.	Ongoing	A.1.8 B.2.8

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
9	XI.M6	Continue the existing BWR Control Rod Drive Return Line Nozzle Program	Ongoing	A.1.9 B.2.9
10	XI.M5	Continue the existing BWR Feedwater Nozzle Program	Ongoing	A.1.10 B.2.10
11	XI.M8	Complete the following enhancement to the existing BWR Penetrations Program: 1. The inservice inspections procedures will be revised to incorporate BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively.	May 8, 2026	A.1.11 B.2.11
12	XI.M7	Continue the existing BWR Stress Corrosion Cracking Program.	Ongoing	A.1.12 B.2.12
13	XI.M4	Complete the following enhancement to the existing BWR Vessel ID Attachment Welds Program: 1. The inservice inspections procedures will be revised to incorporate BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively.	May 8, 2026	A.1.13 B.2.13

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
14	XI.M9	Complete the following enhancement to the existing BWR Vessel Internals Program: 1. The BWR Vessel Internals Program implementing station procedures will be revised to incorporate BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively. 2. An evaluation of the 60-year fluence for the six (6) critical components identified in BWRVIP-234, Table 6-1, will be performed to verify the applicability of the BWRVIP to PNPP. In the unlikely circumstance that the 60-year fluence limits for one or more these components are exceeded, an assessment of the susceptibility of reactor vessel internal components fabricated from CASS to loss of fracture toughness due to thermal aging and neutron irradiation embrittlement will be performed. The required periodic inspections of CASS components determined to be susceptible to loss of fracture toughness due to thermal aging and neutron irradiation embrittlement will be determined based on this assessment.	May 8, 2026	A.1.14 B.2.14

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
15	XI.M21A	Complete the following enhancement to the existing Closed Treated Water Systems Program: 1. The program will be enhanced to ensure aging effects are detected through periodic inspections. Visual inspections will be conducted whenever the system boundary is opened. Additionally, a representative sample of piping and components will be selected based on likelihood of corrosion or cracking and inspected at an interval not to exceed once in 10 years. 2. The program will be enhanced to change the chemical treatment of the Building Heating System from a hydrazine-based regime to one more suitable to the elevated system temperatures experienced at PNPP.	May 8, 2026	A.1.15 B.2.15
16	XI.M24	Complete the following enhancement to the existing Compressed Air Monitoring Program: 1. Include opportunistic inspections of accessible internal surfaces of piping, receivers, compressors, dryers, aftercoolers, and filters within the compressed air systems. 2. A new monitoring and trending program will be developed to monitor and trend periodic dew point readings, results of each opportunistic visual inspection, and annual air samples.	May 8, 2026	A.1.16 B.2.16

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
17	X.E1	Continue the existing Environmental Qualification (EQ) of Electrical Components Program	Ongoing	A.1.17 B.2.17
18	XI.M36	Implement the new External Surfaces Monitoring of Mechanical Components Program	May 8, 2026	A.1.18 B.2.18
19	X.M1	Complete the following enhancements to the existing Fatigue Monitoring Program: 1. Clarify the scope of the Fatigue Monitoring Program within the implementing station procedures. 2. Include environmental correction factors (F_{en} multipliers) for the locations where monitoring the environmental fatigue has been determined to be applicable to ensure the cumulative fatigue, including environmental fatigue, does not exceed the ASME Code, Section III limits.	May 8, 2026	A.1.19 B.2.19
20	XI.M26	Continue the existing Fire Protection Program	Ongoing	A.1.20 B.2.20
21	XI.M27	Complete the following enhancements to the existing Fie Water System Program: 1. The program will include inspections and testing consistent with Appendix L, Table 4a, Fire Water System Inspection and Testing Recommendations, of License Renewal Interim Staff Guidance LR-ISG-2012-02.	May 8, 2026	A.1.21 B.2.21

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
21 (Cont.)	XI.M27	2. As an enhancement to detect aging effects of internal surfaces of buried piping, a portion of the aboveground inspection locations will be selected where above-grade and underground or buried piping environments and material are similar, the above-grade can be extrapolated to evaluate the condition of the underground or buried piping. 3. The program will require that when visual inspections are used to detect loss of material, including loss of material in the piping within the scope of license renewal due to recurring internal corrosion, the inspection technique is capable of detecting surface irregularities that could indicate wall loss to below nominal pipe wall thickness due to corrosion and corrosion product deposition. Where such irregularities are detected, follow-up volumetric wall thickness examinations will be performed. 4. The program will include augmented testing and inspections beyond those of Table 4a for portions of water-based fire protection system components within the scope of license renewal that are (a) normally dry but periodically subjected to flow (e.g., dry-pipe or preaction sprinkler system components) and (b) cannot be drained or allow water to collect: • In each 5-year interval, beginning 5 years prior to the period of extended operation, a flow test or flush sufficient to detect potential flow blockage will be conducted, or a visual inspection of 100 percent		

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
21 (Cont.)	XI.M27	of the internal surface of piping segments will be conducted. • In each 5-year interval of the period of extended operation, 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect will be subject to volumetric wall thickness inspections. Measurement points will be obtained to the extent that each potential degraded condition can be identified (e.g., general corrosion, MIC). The 20 percent of piping inspected in each 5-year interval will be in different locations than previously inspected piping. • If the results of a 100-percent internal visual inspection are acceptable, and the segment is not subsequently wetted, no further augmented tests or inspections are necessary. 5. The program will perform representative sprinkler head sampling (laboratory field service testing) or replacement of sprinkler heads within the scope of license renewal prior to 50 years in-service (installed), and at 10-year intervals thereafter, in accordance with the 2011 Edition of NFPA 25, or until there are no untested sprinkler heads that will see 50 years of service through the end of the period of extended operation.		

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
21 (Cont.)	XI.M27	6. The program will require at a minimum of once per 10 year interval visual inspection of the engine heat exchanger for the diesel driven fire water pump to monitor for conditions that could cause a reduction in heat transfer. 7. The program will provide that if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material will be removed, and its source will be determined and corrected.		
22	XI.M17	Complete the following enhancements to the existing Flow Accelerated Corrosion Program: 1. Site procedures will be enhanced to include pump casings and valve bodies that retain pressure in systems susceptible to FAC. Opportunistic inspections of internal surfaces are conducted during routine maintenance activities to identify degradation.	May 8, 2026	A.1.22 B.2.22
23	XI.M30	Complete the following enhancements to the existing Fuel Oil Chemistry Program: 1. Additional information will be placed in Periodic Maintenance tasks. Periodic Maintenance tasks for the Diesel Fire Pump Fuel Oil Storage Tank will be revised to reflect that the minimum required schedule for inspections to satisfy Aging Management Program requirements are consistent with a 10-year interval.	May 8, 2026	A.1.23 B.2.23

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
23 (Cont.)	XI.M30	2. Volumetric inspection will be performed if visual inspection is not possible, or evidence of degradation is observed during visual inspection.		
24	XI.E5	Implement the new Fuse Holders Program	May 8, 2026	A.1.24 B.2.24
25	XI.M38	Implement the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	May 8, 2026	A.1.25 B.2.25
26	XI.M23	Continue the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program	Ongoing	A.1.26 B.2.26
27	XI.M42	Implement the new Internal Coating/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks Program	May 8, 2026	A.1.27 B.2.27
28	XI.M39	Continue the existing Lubricating Oil Analysis Program	Ongoing	A.1.28 B.2.28
29	XI.S5	Implement the new Masonry Walls Monitoring Program	May 8, 2026	A.1.29 B.2.29
30	XI.M40	Continue the existing Monitoring of Neutron Absorbing Materials Other Than Boraflex Program	Ongoing	A.1.30 B.2.30
31	XI.E6	Implement the one-time Non-EQ Electrical Cable Connections Program	May 8, 2026	A.1.31 B.2.31
32	XI.E3	Complete the following enhancements to the existing Non-EQ Inaccessible Power Cables Program:	May 8, 2026	A.1.32 B.2.32

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
32 (Cont.)	XI.E3	1. Dewatering sump pumps and alarms will be installed in all electrical manholes containing cable with a license renewal intended function. 2. Daily operator rounds will confirm that sump pumps and associated alarms are operable. When the high water level alarm has been on two days in a row, the need for supplemental pumps will be evaluated. When high level has occurred three days in a row, supplemental pumps will be used, as needed, and an engineering evaluation of affected power cable ≥400V in that manhole will be performed. The evaluation may use testing as a diagnostic tool but will consider the significance of the inspection results, the functionality of affected component, potential reportability of the event, the extent of the concern, the potential causes for not meeting the inspection criteria, the corrective actions required, and the likelihood of recurrence. 3. Inspections will be conducted at least annually to determine that cables are not wetted or submerged, that cables/splices and cable support structures are intact, and that sump pumps and associated alarms operate properly. 4. Maintenance plans will be enhanced to ensure all underground in-scope cable ≥400V is tested every six years and after any exposure to significant moisture (wetting or submergence lasting more than a few days).		

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
33	XI.E2	Implement the new Non-EQ Instrumentation Circuits Program	May 8, 2026	A.1.33 B.2.33
34	XI.E1	Complete the following enhancements to the existing Non-EQ Insulated Cables and Connections Program: 1. The program will be enhanced to include a plant-specific procedure for plant walkdowns of adverse localized environments.	May 8, 2026	A.1.34 B.2.34
35	XI.M32	Implement the new One-Time Inspection Program	May 8, 2026	A.1.35 B.2.35
36	XI.M35	Implement the new One-Time Inspection of ASME Code Class 1 Small Bore Piping Program	May 8, 2026	A.1.36 B.2.36
37	XI.M20	Continue the existing Open Cycle Cooling Water System Program	Ongoing	A.1.37 B.2.37
38	XI.S8	Complete the following enhancement to the existing Protective Coating Monitoring and Maintenance Program: 1. The existing PNPP Protective Coating Monitoring and Maintenance Program will be enhanced to comply with the requirements of ASTM D5163-08.	May 8, 2026	A.1.38 B.2.38

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
39	XI.M3	Complete the following enhancements to the existing Reactor Head Closure Stud Bolting Program: 1. The purchasing requirements for reactor head closure stud material will be revised to assure that any studs procured in the future will have measured yield strength of less than 150 ksi.	May 8, 2026	A.1.39 B.2.39
40	XI.M31	Continue the existing Reactor Vessel Surveillance Program	Ongoing	A.1.40 B.2.40
41	XI.S7	Complete the following enhancements to the existing RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants Program: 1. The scope of the program will be enhanced to manage aging effects associated with the ESW swale, and the flood mitigating features of the major stream, major stream culvert, remnant minor stream, and the diversion stream channel and diversion stream berm. The program implementing procedure will also include a listing of these earthen structures that are within the scope of license renewal. The program implementing procedure will also include a listing of existing procedures/instructions that are credited to manage the aging effects of water control structures that are within the scope of this aging management program. Parameters monitored will include settlement, depressions, sink holes, slope stability (e.g., irregularities in alignment and variances from originally constructed slopes), seepage, proper	May 8, 2026	A.1.41 B.2.41

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
41 (Cont.)	XI.S7	functioning of drainage systems, and degradation of slope protection features. The aging effects associated with concrete are loss of material, cracking, and various changes in material properties (that is, loss of bond, increase in porosity and permeability, reduction of strength, and differential settlement). The aging effects associated with earthen structures (rock, stone and soil) are loss of form and loss of material. The aging effects associated with wooden clamps supporting the electrical cables in manholes are change in material properties due to weathering, chemical degradation, insect infestation, repeated wetting and drying, fungal decay. 2. The program will be enhanced to include preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi)). 3. The program will be enhanced to include preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts.*		

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
41 (Cont.)	XI.S7	4. The program will be enhanced to include monitoring and inspection of the major stream culvert, and the flood mitigation features of the major stream, remnant minor stream, the diversion stream berm and channel, and the ESW swale. The program implementing procedure will also include a listing of these earthen structures that are within the scope of license renewal. The program implementing procedure will also include a listing of existing procedures/instructions that are credited to manage the aging effects of water control structures that are within the scope of this aging management program. Parameters monitored will include settlement, depressions, sink holes, slope stability (e.g., irregularities in alignment and variances from originally constructed slopes), seepage, proper functioning of drainage systems, and degradation of slope protection features. 5. Steel components are monitored for rust, erosion, corrosion, cavitation and weld cracks. 6. The program will be enhanced to include monitoring and inspection of earthen embankment structures associated with the major stream, remnant minor stream and the new diversion stream channel including the inline spillway structure at the outfall of the new channel.		

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
41 (Cont.)	XI.S7	The berm inspections will include the following items: a) Identify if there are any wet areas, erosion, or slides b) Identify if there are obstructions in the stream that could partially block or prevent flow c) Identify bare spots needing re-vegetation d) Locate any riprap or erosion protection that has been displaced e) Identify cracks that may indicate potential excessive settlement (>1 foot) or slope instability f) Identify any burrowing rodent holes that could impact the performance or stability of the berm		
42	XI.M33	Implement the new Selective Leaching Program.	May 8, 2026	A.1.42 B.2.42
43	XI.S6	Complete the following enhancements to the existing Structures Monitoring Program: 1. The program implementing procedure will be enhanced to include a listing of Unit 1 and Unit 2 structures and structural bulk commodities within the scope of license renewal that credit the Structures Monitoring Program for aging management. 2. The program implementing procedure will list the current procedures/instructions that combine to manage the aging effects of the structural elements that are within the scope of the structures monitoring program as part of aging management for license renewal.	May 8, 2026	A.1.43 B.2.43

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
43 (Cont.)	XI.S6	3. The program will be enhanced to monitor the structural integrity of the plant underdrain system including the porous concrete sub-foundations. 4. The program will be enhanced to monitor ground water chemistry including accounting for seasonal variations. 5. The program will be enhanced to monitor the loss of material and flow blockage in the plant storm drain piping. 6. The program will be enhanced to inspect the in-scope non-safety related/non-seismic masonry walls for loss of material (spalling, scaling), change in material properties and cracking due to freeze-thaw. 7. The program will be enhanced to include preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 ksi). 8. The program will be enhanced to include preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.		

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
43 (Cont.)	XI.S6	9. The program will be enhanced to monitor the structural integrity of the plant underdrain system including the porous concrete sub-foundations. The program elements would include: • the plant underdrain system maintenance and inspection • monitoring for building settlement, • monitoring the groundwater elevation. 10. The program will be enhanced to monitor ground water chemistry on a frequency of at least once every five years including accounting for seasonal variations for pH, chlorides, and sulfates and verify that it remains non-aggressive, or evaluate results exceeding criteria to assess impact, if any, on below-grade concrete. 11. The program will be enhanced to require that structures and structural components are monitored on a frequency not to exceed 5 years. 12. The program will be enhanced to specify that a representative sample of high strength (actual measured yield strength ≥ 150 ksi or 1,034 MPa) structural bolts greater than 1 inch (25 mm) in diameter are monitored for SCC at least once every 10 years.		

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
43 (Cont.)	XI.S6	13. The program will be enhanced to monitor accessible sliding surfaces to detect significant loss of material due to wear, corrosion, debris, dirt, distortion, or overload that could restrict or prevent sliding of surfaces as required by design. 14. The program will be enhanced to require inspection of elastomeric components for cracking, loss of material and hardening. Visual inspections of elastomeric components are to be supplemented by feel or manipulation to detect hardening. Include instructions to enhance the visual examination of elastomeric material with physical manipulation of at least ten percent of available surface area. 15. The program will be enhanced to require (a) evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas and (b) examination of representative samples of the exposed portions of the below grade concrete, when excavated for any reason. If normally inaccessible areas become accessible due to planned activities, an inspection of these areas shall be conducted.		

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
43 (Cont.)	XI.S6	16. The program will be enhanced to require the plant storm drain piping to be monitored for: • Unacceptable flow blockage • Observed structural degradation This monitoring will consist of direct observation (storm drain grating flow and blockage) and periodic remote visual inspections of sampled portions of storm drain system piping. Additionally, the site's implementing document will include required inspections following offsite agency confirmation that an earthquake has occurred in the area of the plant for any sign of ground settlement that could be an indication of storm drain piping collapse to assure the integrity of the piping. 17. Perform special inspections of the storm drain system immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls. 18. Plant procedures will be enhanced to prescribe quantitative acceptance criteria based on the acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11 and relevant AISC specifications. Industry and plant specific operating experience will also be considered in the development of the acceptance criteria.		

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
43 (Cont.)	XI.S6	19. Loose bolts and nuts and cracked high strength bolts will not be acceptable unless accepted by engineering evaluation. 20. Structural sealants will be acceptable if the observed loss of material, cracking, and hardening will not result is loss of sealing. 21. Elastomeric vibration isolation elements will be acceptable if there is no loss of material, cracking, or hardening that could lead to the reduction or loss of isolation function. 22. Acceptance criteria for sliding surfaces will be (a) no indications of excessive loss of material due to corrosion or wear and (b) no debris or dirt that could restrict or prevent sliding of the surfaces as required by design. 23. Acceptance criteria for high strength structural bolting shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section V, Article 5, Appendix IV. 24. The program will be enhanced to require that personnel performing inspections and evaluations meet the qualifications specified within ACI Report 349.3R with respect to knowledge of inservice inspection of concrete and visual acuity requirements.		

Table A.3
License Renewal
Commitments

Item No.	AMP	Commitment	Implementation Schedule	Related LRA Sections
43 (Cont.)	XI.S6	25. Unimpregnated and impregnated (with elastomer) fiber glass fabric will be monitored for cracking, delaminating and visible deterioration.		
44	XI.M2	Continue the existing Water Chemistry Program	Ongoing	A.1.44 B.2.44
45	N/A	Continue the existing operating experience program to evaluate age-related degradation or aging management impacts to structures and components to manage aging management program effectiveness and determine the need for new programs consistent with LR-ISG-2011-05.	Ongoing	A.1 B.1.4

APPENDIX B

AGING MANAGEMENT PROGRAMS

Aging Management Programs

Table of Contents

Appendix B Tables

B.1.1 OVERVIEW

License renewal aging management program (AMP) descriptions are provided in this appendix for each program credited for managing aging effects based upon the aging management review results provided in Sections 3.1 through 3.6.

Each Perry Nuclear Power Plant (PNPP) aging management program described in this appendix is evaluated on the basis of 10 program elements in accordance with the guidance in Appendix A.1, Section A.1.2.3 of NUREG-1800, the Standard Review Plan for License Renewal.

B.1.2 FORMAT OF PRESENTATION

For those AMPs that are comparable to the programs described in Sections X and XI of NUREG-1801, the *Generic Aging Lessons Learned (GALL) Report*, the program evaluation is presented in the following summary format:

- **Program Description** – An abstract of the overall program is provided.
- **NUREG-1801 Consistency** – A statement is made regarding consistency between the PNPP program and the corresponding NUREG-1801 program.
- **Exceptions to NUREG-1801** – Exceptions to NUREG-1801 programs are outlined and a justification for the exception(s) is provided.
- **Enhancements** – Enhancements to programs necessary to ensure consistency with NUREG-1801 or to expand the scope of the program for license renewal are identified. Each enhancement is listed along with the affected program element and a proposed schedule for completion of the enhancement.
- **Operating Experience** – Discussion of operating experience information specific to the program is provided.
- **Conclusion** – A conclusion section provides a statement of reasonable assurance of program effectiveness.

There are no plant specific programs at PNPP needed to effectively manage the aging effects of in scope components.

B.1.3 QUALITY ASSURANCE PROGRAM AND ADMINISTRATIVE CONTROLS

The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2, *Quality Assurance For Aging Management Programs (Branch Technical Position IQMB-1)* of NUREG-1800. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the safety-related and nonsafety related systems, structures, components (SSCs), and commodity groups that are subject to AMR. Generically, the three elements are applicable as follows:

Corrective Actions:

Corrective actions are implemented through the PNPP corrective action program that satisfies the requirements of 10 CFR 50, Appendix B, Criterion XVI. Conditions adverse to quality, an all-inclusive term used in reference to failures, malfunctions, deficiencies, defective items, and non-conformances are identified, reported to management, and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the root cause is determined and that corrective actions are taken to preclude recurrence. Nonsafety related SSCs that are subject to aging management during the period of extended operations are captured under the corrective action program as Conditions Adverse to Regulatory Compliance (CARC).

The corrective action program is the subject of periodic NRC examination and PNPP self-assessment and audit. The current program is, therefore, adequate for aging management considerations.

Confirmation Process:

The focus of the confirmation process is on the follow-up actions taken to verify effective implementation of corrective actions and to preclude repetition of significant conditions adverse to quality. The corrective action program includes the requirement that measures be taken to preclude repetition of significant conditions adverse to quality. These measures include actions to verify effective implementation of proposed corrective actions. The confirmation process is part of the corrective action program and, for significant conditions adverse to quality, includes:

- reviews to assure proposed actions are adequate,
- tracking and reporting of open corrective actions,
- identification of root cause, and
- reviews of corrective action effectiveness.

Corrective action program effectiveness reviews are conducted to ensure that corrective actions have been completed and to identify any repetition of events. The corrective action program is also monitored for potentially adverse trends. The existence of an adverse trend due to recurring or repetitive adverse conditions will result in the initiation of follow-up actions in the corrective action program.

Administrative Controls:

Administrative controls that govern aging management activities are established within the document control procedures that implement: (1) industry standards related to administrative controls and quality assurance for the operational phase of nuclear power plants, and (2) the requirements of 10 CFR 50, Appendix B, Criterion VI.

Plant policies, directives, and procedures are written and controlled to specify and manage various activities, particularly those related to compliance with 10 CFR 50, Appendix B. The phrase “administrative control” refers to the adherence to policies, directives, and procedures, and includes the formal review and approval process that plant policies, directives, and procedures undergo as they are issued (and subsequently revised). The individual documents (i.e., the plant policies, directives, and procedures), in conjunction with the plant's quality assurance program documents, provide the overall administrative framework to ensure regulatory requirements are met.

B.1.4 OPERATING EXPERIENCE

The operating experience review demonstrates the effectiveness of the plant programs and activities that are credited with the aging management of structures and components. A comprehensive industry operating experience review was completed for a time frame of at least 10 years and the results used to identify specific aging effects requiring management. The search of operating experience included internal issues related to aging effects from the PNPP corrective action program in addition to industry operating experience (OE) from the Institute of Nuclear Power Operations (INPO) and from the World Association of Nuclear Operators (WANO) as evaluated from Subject Matter Experts (SMEs) from Nuclear Energy Institute (NEI) industry working groups.

Plant procedures require that the discovery of conditions adverse to quality be documented in accordance with the PNPP corrective action program. A review of plant records from 2013 and later was performed to identify examples of age-related degradation related to current plant operation. The scope of the review included reports generated under the corrective action program and licensee event reports. These records provide documentation of situations where systems, structures, and components exhibit adverse conditions, including conditions adverse to quality and age-related degradation. Keywords related to aging and degradation were used to search the records.

Industry operating experience was also evaluated by crediting NEI SME reviews of events documented in the Institute of Nuclear Power Operations (INPO) operating experience database in addition to issues identified in NRC inspection reports.

The operating experience review included consideration of the results of programmatic assessments performed by the PNPP and of those performed by outside agencies, including the NRC. Industry operating experience was considered for existing programs and for new programs. The operating experience review provides objective evidence that the effects of aging will be managed for the period of extended operation.

Operating experience from plant-specific and industry sources is captured and systematically reviewed on an ongoing basis in accordance with the quality assurance program, which meets the requirements of 10 CFR 50, Appendix B, and the operating experience program, which meets the guidance of NUREG-0737, *Clarification of TMI Action Plan Requirements*, Item I.C.5, *Procedures for Feedback of Operating Experience to Plant Staff*. The operating experience program interfaces with and relies on active participation in the INPO operating experience program, as endorsed by the NRC. The PNPP program processes and procedures for the ongoing review of operating experience include the following attributes:

- Training on age-related degradation and aging management is provided to those personnel responsible for implementing aging management programs and who may submit, screen, assign, evaluate, or otherwise process plant-specific and industry operating experience to ensure they are qualified for the task. This training is to occur on the frequency determined by PNPP training procedures and processes and includes provisions to accommodate the turnover of plant personnel.
- While the programs and procedures may specify reviews of certain sources of information, such as revisions to NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, and Institute of Nuclear Power Operations reports, they allow for any potential source of relevant plant-specific or industry operating experience information.
- The processes are adequate so as to not preclude the consideration of operating experience related to aging management. The processes allow for appropriately gathering information on structures and passive components within the scope of license renewal, their materials, environments, aging effects, and aging mechanisms, and the aging management programs credited for managing the effects of aging, including the activities under these programs (e.g., inspection methods, preventive actions, or evaluation techniques).
- Plant-specific operating experience, including aging-related operating experience, is documented in condition reports and processed using the PNPP corrective action program. The corrective action program database includes an indicator of conditions that require an “Aging Management Evaluation” for plant-specific operating experience concerning potential age-related degradation to structures and components within the scope of license renewal and managed by a license renewal aging management program. Condition reports for adverse conditions and related documents captured in the corrective action program database are quality records and are auditable and retrievable.
- Industry operating experience, including aging-related operating experience, is entered into the Operating Experience Program database and screened for applicability to PNPP. The Operating Experience Program database includes an “Aging Management Evaluation” indicator to identify plant-specific and industry operating experience concerning age-related degradation to structures and components within the scope of license renewal and managed by a license renewal aging management program. Documents captured in the Operating Experience Program database are retrievable.
- Evaluations of internal and external aging-related operating experience issues associated with structures and passive components will include consideration of the affected structure or component, material, environment, aging effect, aging mechanism, and aging management program, with feedback to the affected aging management program owner for consideration of the impact to aging management program effectiveness.
- Aging management program owners will review data collected by program activities, use the corrective action program to document adverse conditions to

ensure they will be addressed and corrected, maintain required records for the program, maintain the program current, and implement revisions as needed based on program results and internal or external operating experience evaluations. Revision of existing or development of new aging management programs based on operating experience evaluations is performed through corrective actions using the corrective action program, or by action items associated with the Operating Experience Program.

- Noteworthy plant-specific aging-related operating experience is shared with the other Energy Harbor sites and the industry. The Operating Experience Program procedure provides guidance on sharing internal operating experience, using evaluation criteria for events or issues related to aging management such as:
    - Discovery of a previously unknown or unexpected aging effect or aging mechanism for the applicable material and environment combination; or,
    - Recommendation for a significant change in an aging management program (e.g., a significant change to monitoring or inspection frequency or technique, or to preventive actions).

The extensive industry and plant-specific operating experience review provides the basis for the determination that existing programs are either effective or require enhancement; that one-time inspections are appropriate to verify that either aging is not occurring or that aging is being effectively managed by an existing program; or that a new program will effectively manage the effects of aging. The individual documents (i.e., the plant policies, directives, and procedures), in conjunction with the plant's corrective action program, will provide the overall administrative framework to ensure operating experience is evaluated to maintain the effectiveness of the plant programs and activities that are credited with the aging management of structures and components.

As addressed in Appendix A, PNPP will continue the existing operating experience program to evaluate age-related degradation or aging management impacts to structures and components to manage aging management program effectiveness and determine the need for new programs consistent with LR-ISG-2011-05, *Ongoing Review of Operating Experience*. In addition, the effectiveness of the PNPP AMPs and activities will be completed periodically per the guidance of NEI 14-12, *Aging Management Program Effectiveness*. The program effectiveness reviews will include evaluation of the AMP or activity against the latest NRC and industry guidance documents and standards that are relevant to the particular program or activity. If there is an indication that the effects of aging are not being adequately managed then that will be documented in the corrective action process to either enhance the AMPs or develop and implement new AMPs, as appropriate.

Therefore, the aging management programs are informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience, as discussed in the GALL Report and the applicable industry and NRC guidance.

B.1.5 LIST OF AGING MANAGEMENT PROGRAMS

Table B.1-1 provides a listing of the NUREG-1801 aging management programs and the corresponding aging management programs for PNPP. Table B.1-2 provides a summary of the aging management programs for PNPP with respect to consistency with NUREG-1801 aging management programs, information on whether programs are existing or new, whether enhancements are required, or exceptions have been taken, and whether the programs are plant-specific. As depicted in Table B.1-2, there are no plant specific AMPs in the PNPP License Renewal Application (LRA).

Each aging management program credited for license renewal is addressed in Section B.2.

Table B.1-1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	LRA Section
X.M1	Fatigue Monitoring	Fatigue Monitoring	B.2.19
X.S1	Concrete Containment Tendon Prestress	Not applicable. PNPP does not have pre-stressed tendons in the containment structure.	N/A
X.E1	Environmental Qualification (EQ) of Electric Components	Environmental Qualification (EQ) of Electrical Components	B.2.17
XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	B.2.3
XI.M2	Water Chemistry	Water Chemistry	B.2.44
XI.M3	Reactor Head Closure Stud Bolting	Reactor Head Closure Stud Bolting	B.2.39
XI.M4	BWR Vessel ID Attachment Welds	BWR Vessel ID Attachment Welds	B.2.13
XI.M5	BWR Feedwater Nozzle	BWR Feedwater Nozzle	B.2.10
XI.M6	BWR Control Rod Drive Return Line Nozzle	BWR Control Rod Drive Return Line Nozzle	B.2.9
XI.M7	BWR Stress Corrosion Cracking	BWR Stress Corrosion Cracking	B.2.12
XI.M8	BWR Penetrations	BWR Penetrations	B.2.11
XI.M9	BWR Vessel Internals	BWR Vessel Internals	B.2.14
XI.M10	Boric Acid Corrosion	PWR Only	N/A
XI.M11B	Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs only)	PWR Only	N/A
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Not applicable. PNPP RCPB CASS components consist of valve bodies, pump casings and the main steam flow restrictors (4 ea.). The valve bodies and pump casings are excluded from screening. The restrictors	N/A

Table B.1-1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	LRA Section
		are not susceptible to thermal aging embrittlement since they are composed of low-molybdenum CASS (CF8) with a ferrite content of less than 20 percent as confirmed by CMTRs.	
XI.M16A	PWR Vessel Internals	PWR Only	N/A
XI.M17	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion	B.2.22
XI.M18	Bolting Integrity	Bolting Integrity	B.2.7
XI.M19	Steam Generators	PWR Only	N/A
XI.M20	Open-Cycle Cooling Water System	Open-Cycle Cooling Water System	B.2.37
XI.M21A	Closed Treated Water Systems	Closed Treated Water Systems	B.2.15
XI.M22	Boraflex Monitoring	Not applicable. PNPP does not use Boraflex panels in its spent fuel pool racks	N/A
XI.M23	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	B.2.26
XI.M24	Compressed Air Monitoring	Compressed Air Monitoring	B.2.16
XI.M25	BWR Reactor Water Cleanup System	Not applicable. RWCS piping downstream of 2nd isolation valve is CS and therefore, not subject to GL 88-01	N/A
XI.M26	Fire Protection	Fire Protection	B.2.20
XI.M27	Fire Water System	Fire Water System	B.2.21
XI.M29	Aboveground Metallic Tanks	Aboveground Metallic Tanks	B.2.2
XI.M30	Fuel Oil Chemistry	Fuel Oil Chemistry	B.2.23
XI.M31	Reactor Vessel Surveillance	Reactor Vessel Surveillance	B.2.40
XI.M32	One-Time Inspection	One-Time Inspection	B.2.35
XI.M33	Selective Leaching	Selective Leaching	B.2.42

Table B.1-1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	LRA Section
XI.M35	One-time Inspection of ASME Code Class 1 Small Bore-Piping	One-Time Inspection of ASME Code Class 1 Small Bore-Piping	B.2.36
XI.M36	External Surfaces Monitoring of Mechanical Components	External Surfaces Monitoring of Mechanical Components	B.2.18
XI.M37	Flux Thimble Tube Inspection	Not applicable. PNPP is a GE design that does not have flux thimble tubes.	N/A
XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	B.2.25
XI.M39	Lubricating Oil Analysis	Lubricating Oil Analysis	B.2.28
XI.M40	Monitoring of Neutron-Absorbing Materials Other than Boraflex	Monitoring of Neutron-Absorbing Materials Other Than Boraflex	B.2.30
XI.M41	Buried and Underground Piping and Tanks	Buried and Underground Piping and Tanks	B.2.8
XI.M42	Internal Coatings/Linings for in-Scope Piping, Piping Components, Heat Exchangers, and Tanks	Internal Coatings/Linings for in-Scope Piping, Piping Components, Heat Exchangers, and Tanks	B.2.27
XI.S1	ASME Section XI, Subsection IWE	ASME Section XI, Subsection IWE	B.2.4
XI.S2	ASME Section XI, Subsection IWL	ASME Section XI, Subsection IWL	B.2.6
XI.S3	ASME Section XI, Subsection IWF	ASME Section XI, Subsection IWF	B.2.5
XI.S4	10 CFR Part 50, Appendix J	10 CFR 50, Appendix J	B.2.1
XI.S5	Masonry Walls Monitoring	Masonry Walls Monitoring	B.2.29
XI.S6	Structures Monitoring	Structures Monitoring	B.2.43
XI.S7	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	B.2.41

Table B.1-1
Correlation of NUREG-1801 and PNPP Aging Management Programs

NUREG-1801 Number	NUREG-1801 Program	PNPP Program	LRA Section
XI.S8	Protective Coating Monitoring and Maintenance Program	Protective Coating Monitoring and Maintenance	B.2.38
XI.E1	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Insulated Cables and Connections	B.2.34
XI.E2	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Non-EQ Instrumentation Circuits	B.2.33
XI.E3	Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Inaccessible Power Cables	B.2.32
XI.E4	Metal Enclosed Bus	Not applicable. There are no in-scope metal enclosed bus for PNPP	N/A
XI.E5	Fuse Holders	Fuse Holders	B.2.24
XI.E6	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Electrical Cable Connections	B.2.31

Table B.1-2
Consistency of PNPP Aging Management Programs with NUREG-1801

Program Name	New/ Existing	Consistent with NUREG-1801	Consistent with NUREG-1801 with Exceptions	Plant Specific	Enhancement Required
10 CFR 50, Appendix J	Existing	Yes	--	--	--
Aboveground Metallic Tanks	New	Yes	--	--	--
ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	Existing	Yes	--	--	--
ASME Section XI, Subsection IWE	Existing	Yes	--	--	--
ASME Section XI, Subsection IWF	Existing	Yes	--	--	Yes
ASME Section XI, Subsection IWL	Existing	Yes	--	--	--
Bolting Integrity	Existing	Yes	--	--	Yes
Buried and Underground Piping and Tanks	Existing	Yes	--	--	--
BWR Control Rod Drive Return Line Nozzle	Existing	Yes	--	--	--
BWR Feedwater Nozzle	Existing	Yes	Yes	--	
BWR Penetrations	Existing	Yes	--	--	Yes
BWR Stress Corrosion Cracking	Existing	Yes	--	--	--
BWR Vessel ID Attachment Welds	Existing	Yes	Yes	--	Yes
BWR Vessel Internals	Existing	Yes	--	--	Yes
Closed Treated Water Systems	Existing	Yes	--	--	Yes
Compressed Air Monitoring	Existing	Yes	--	--	Yes

Table B.1-2
Consistency of PNPP Aging Management Programs with NUREG-1801

Program Name	New/ Existing	Consistent with NUREG-1801	Consistent with NUREG-1801 with Exceptions	Plant Specific	Enhancement Required
Environmental Qualification (EQ) of Electrical Components	Existing	Yes	--	--	--
External Surfaces Monitoring of Mechanical Components	New	Yes	--	--	--
Fatigue Monitoring	Existing	Yes	--	--	Yes
Fire Protection	Existing	Yes	--	--	--
Fire Water System	Existing	Yes	--	--	Yes
Flow-Accelerated Corrosion	Existing	Yes	--	--	Yes
Fuel Oil Chemistry	Existing	Yes	--	--	Yes
Fuse Holders	New	Yes	--	--	--
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	New	Yes	--	--	--
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Existing	Yes	--	--	--
Internal Coatings/Linings for in-Scope Piping, Piping Components, Heat Exchangers, and Tanks	New	Yes	--	--	--
Lubricating Oil Analysis	Existing	Yes	--	--	--
Masonry Walls Monitoring	New	Yes	--	--	--

Table B.1-2
Consistency of PNPP Aging Management Programs with NUREG-1801

Program Name	New/ Existing	Consistent with NUREG-1801	Consistent with NUREG-1801 with Exceptions	Plant Specific	Enhancement Required
Monitoring of Neutron-Absorbing Materials Other Than Boraflex	Existing	Yes	--	--	--
Non-EQ Electrical Cable Connections Program	New	Yes	--	--	--
Non-EQ Inaccessible Power Cables Program	Existing	Yes	--	--	Yes
Non-EQ Instrumentation Circuits Program	New	Yes	--	--	--
Non-EQ Insulated Cables and Connections Program	Existing	Yes	--	--	Yes
One-Time Inspection Program	New	Yes	--	--	--
One-Time Inspection of ASME Code Class 1 Small Bore-Piping Program	New	Yes	--	--	--
Open-Cycle Cooling Water System Program	Existing	Yes	--	--	--
Protective Coating Monitoring and Maintenance Program	Existing	Yes	--	--	Yes
Reactor Head Closure Stud Bolting Program	Existing	Yes	Yes	--	Yes
Reactor Vessel Surveillance Program	Existing	Yes	--	--	--
RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program	Existing	Yes	--	--	Yes

Table B.1-2
Consistency of PNPP Aging Management Programs with NUREG-1801

Program Name	New/ Existing	Consistent with NUREG-1801	Consistent with NUREG-1801 with Exceptions	Plant Specific	Enhancement Required
Selective Leaching Program	New	Yes	Yes	--	--
Structures Monitoring Program	Existing	Yes	--	--	Yes
Water Chemistry Program	Existing	Yes	Yes	--	--

B.2.0 AGING MANAGEMENT PROGRAMS

The applicable PNPP AMPs are listed alphabetically per the guidance for LRA Appendix B from NEI 95-10, Revision 6, Table 6.3-2, *Guidance for Preparing the Standard License Renewal Application Format.*

B.2.1 10 CFR 50, APPENDIX J PROGRAM

Program Description

The Containment Leak Rate Program consists of tests performed in accordance with the regulations and guidance provided in 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B; Nuclear Energy Institute (NEI) 94-01, "Industry Guideline for Implementing Performance-Based Options of 10 CFR Part 50, Appendix J"; and ANSI/ANS 56.8, "Containment System Leakage Testing Requirements." The program provides for detection of pressure boundary degradation due to aging effects such as loss of leak tightness, loss of material, cracking, or loss of sealing in various systems penetrating containment. The program also provides for detection of pressure boundary degradation due to aging effects associated with elastomers including change in material properties, cracking, or loss of sealing in various systems penetrating containment. The visual inspection will detect change in material properties such as cracking or crazing, swelling, discoloration and melting. Loss of sealing is detected by local leak rate tests and may be the result of change in material properties. The program also provides for detection of age-related degradation in material properties of gaskets, 0-rings, and packing materials for the containment pressure boundary access points.

The 10 CFR Part 50, Appendix J Program is an existing performance monitoring program that monitors containment leakage rates. Containment leak rate tests are required to assure that: (a) leakage through primary Containment and systems and components penetrating primary Containment will not exceed allowable values specified in technical specifications, and (b) periodic surveillance of primary Containment penetrations and isolation valves is performed so that proper maintenance and repairs are made. Appendix J, Option B is used. The Containment leak rate tests are performed in accordance NEI 94-01, Revision 3-A, and the conditions and limitations specified in NEI 94-01, Revision 2-A, of the same name, dated October 2008.

Prior to performance of the Integrated Leak Rate Test (Type A test), general visual examinations (VT-3) are conducted on the containment accessible interior and exterior surface areas in accordance with ASME Section XI, Subsections IWE (AMP XI.S1), and IWL (AMP XI.S2) to detect evidence of degradation that may affect structural integrity.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The 10 CFR Part 50, Appendix J Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.S4, *10 CFR Part 50, Appendix J*.

Exceptions to NUREG-1801

None

Note: Complies with a later revision to NEI 94-01 found acceptable to the NRC

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the 10 CFR Part 50, Appendix J Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The most recent Integrated Leak Rate Test (ILRT) was performed in April 2023 (Cycle 19 refueling outage). The calculated leakage rate was 0.1459 weight percent/24 hours for the PNPP 2023 ILRT. This result was within the acceptance criteria of 0.150 weight percent/24 hours (ILRT Acceptance Criteria, 0.75 La) allowed by the technical specifications for as-left containment leakage rate limits. These results show that equipment is being adequately maintained and that equipment maintenance has been capable of creating a safety margin between the technical specifications allowable limits and the as-tested values. The test results show the effects of aging are effectively being managed for the primary containment boundary.

The previous Integrated Leak Rate Test (ILRT) was performed in May 2009 (Cycle 12 refueling outage). The calculated leakage rate was 0.1195 weight percent/24 hours for the PNPP 2009 ILRT. This result was well below the acceptance criteria of 0.150 weight percent/24 hours (ILRT Acceptance Criteria, 0.75 La) allowed by the technical specifications for as-left containment leakage rate limits. These results show that equipment is being adequately maintained and that equipment maintenance has been capable of creating a significant safety margin between the technical specifications allowable limits and the as-tested values. The test results show the effects of aging are effectively being managed for the primary containment boundary.

In 2014, the NRC issued IN 2014-07, "Degradation of Leak-Chase Channel Systems for Floor Welds of Metal Containment Shell and Concrete Containment Metallic Liner." The Information Notice concerns degradation of floor weld leak-chase channel systems of steel containment shell and concrete containment metallic liner that could affect leak-tightness and aging management of containment structures.

PNPP, being a BWR/6 with a GE Mark III containment, does not have some of the systems or components described in the IN. The PNPP containment is a free-standing steel cylinder with a flat steel bottom on a concrete foundation and a steel dome.

Additionally, the lower region between the inside containment wall and outside drywell wall contains a suppression pool. PNPP does have a leak chase system. There is a system embedded in concrete for the upper containment pools, but it is not part of containment integrity. There is also a leak chase system welded to the bottom of containment; however, it is submerged in the suppression pool. This allows some visual examination to be performed during IWE examinations of the wetted surfaces (visual exams of suppression pool surfaces). Containment shell welds are inside of the leak chase channels, making them inaccessible. These channels are exposed to demineralized water and constructed of stainless steel, so corrosion will be minimal or nonexistent. Based on the above, PNPP is not affected by IN 2014-07.

NRC Regulatory Issue Summary (RIS) 2016-07 informed the industry of potential ASME Code non-compliance related to failure to accurately identify containment areas for inspection. There are two distinct but related areas of concern. The first pertains to the use and inspection of moisture barriers, which are not in use at PNPP. The second pertains to correctly identifying surface areas requiring augmented examination and performing the associated inspections. PNPP previously performed an evaluation that determined there are no surface areas requiring augmented examination. Therefore, PNPP is not susceptible to the two areas of concern presented in the RIS.

In February 2020 and March 2021, Containment Isolation Valve 1G33-F039 had LLRT failure mechanism determination: The installed valve in functional location 1G33-F039 was scheduled to be cut out and replaced in Refuel Outage 18 (1R18) due to excessive leakage measured during local leak rate testing (LLRT). This leakage far exceeded LLRT administrative acceptance criteria in 1R12, 1R14, 1R15, 1R16, 1R17 and 1R18 for the penetration, routinely accounting for 20 to 50 percent of containment leakage. Corrective actions were taken to replace the valve via an engineering change package and the implementing work order.

Conclusion

The continued implementation of the 10 CFR Part 50, Appendix J Program provides reasonable assurance that the effects of aging will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.2 ABOVEGROUND METALLIC TANKS PROGRAM

Program Description

The Aboveground Metallic Tanks Program is a new condition monitoring program that will manage the loss of material on the outside and inside surfaces of aboveground tanks in the scope of license renewal constructed on concrete or soil. The NUREG-1801 XI.M29 program is revised as described in LR-ISG-2012-02 and provides for the management of internally coated tanks using XI.M42, *Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers and Tanks.*

The only in-scope component is the uninsulated steel (with internal coating) condensate storage tank (CST). Preventive measures to mitigate corrosion were applied during construction, such as using the appropriate materials and use of a protective multi-layer sand barrier beneath the tank. The protective layers of sand in the vapor barrier beneath the tank is sloped toward the draw-off sump to minimize the amount of water and moisture at the coated surface of the tank. Both the concrete ring foundation and the layers of vapor barrier sand are supported by a reinforced concrete foundation. The tank material is not subject to cracking and caulking is not used. There are no indoor tanks included in this program.

Visual inspection of the exterior of the tank will be conducted once each refueling cycle as described in the ISG-2012-02, Appendix M, Table 4a. Ultrasonic testing (UT) of the tank bottom from the tank interior, to assess the thickness against the specified thickness will be conducted as described in the ISG-2012-02, Appendix M, Table 4a.

The tank internal surfaces and internal coatings will be managed by XI.M42, *Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers and Tanks.*

An exterior visual inspection of the tank will occur at least once each operating cycle beginning no later than six months prior to the period of extended operation. UT examination from the inside of the tank to assess the thickness of the bottom against the design specified thickness will be conducted no later than six months prior to the period of extended operation and continue each 10 years thereafter.

NUREG-1801 Consistency

The Aboveground Metallic Tanks Program is a new program for PNPP that will be consistent with the 10 elements of an effective aging management program as described in ISG-2012-02 Appendix M as modified by ISG-2013-01.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Above Ground Metallic Tanks Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Aboveground Metallic Tanks Program is a new program. Industry operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is executed and will be factored into the program via the confirmation and corrective action elements of PNPP's 10 CFR 50 Appendix B quality assurance program.

A review of plant operating experience was performed. No aging effects were identified. No instances involving defects described as wall thinning, pinhole leaks, cracks, or through-wall flaws in the CST were identified. One instance of rust in the internal lining of a tank was found, the condition would be managed by XI.M42*, Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers and Tanks*.

In July 2021, visual inspection of the CST exterior surfaces was performed. No leakage, corrosion or deep pitting was identified.

In March 2021, inspection was performed inside the CST. In December 2021, cleaning, was performed, class “B” cleanliness was met.

Conclusion

The visual inspection and UT examination methods used to detect aging effects are proven industry techniques that have been effectively used at PNPP in other programs.

The Aboveground Metallic Tanks Program will provide reasonable assurance that aging effects will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.3 ASME SECTION XI INSERVICE INSPECTION, SUBSECTIONS IWB, IWC, AND IWD PROGRAM

PROGRAM DESCRIPTION

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program is an existing condition monitoring program that meets the inservice inspection requirements specified by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section XI, as modified by 10 CFR 50.55a.

The program includes periodic visual, surface, and volumetric examination and leakage (pressure) testing of American Society of Mechanical Engineers (ASME) Class 1, 2, or 3 pressure-retaining components, and their integral attachments, as well as repair, modification, or replacement of same. This program will also manage the aging effects of the reactor vessel support skirt. Also, the program has been augmented to include Operating Experience (OE), UFSAR and regulatory commitments beyond 10 CFR 50.55a(g), and inspection guidance issued under the NEI 03-08 Materials Degradation initiative. In addition, risk informed inservice inspections for Class 1 and Class 2 piping welds and Class 3 or Non-Class Components are conducted in accordance with Code Case N716-1, *Alternative Piping Classification and Examination Requirements. Section XI, Division 1*. This Code Case has been endorsed by Regulatory Guide 1.147, Rev. 19, issued October 2019.

The applicable ASME Code for the current (fourth) 10 year inspection interval for PNPP, which commenced on May 18, 2019, is the ASME XI, 2013 Edition.

In accordance with 10 CFR 50.55a(g)(4)(ii), the ISI program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified 12 months before the start of the inspection interval. Any deviation from ASME Code, Section XI requirements must be approved by the NRC per a relief request.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M1 *ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Because the ASME Code is a consensus document that has been widely used over a long period, it has been shown to be effective in managing aging effects in Class 1, 2, and 3 components and their integral attachments in light-water cooled power plants.

As discussed in element 10 to NUREG-1801, Section XI.M1, this program considers the technical information and industry operating experience provided in NRC IN 97-19, IN 84-18, IN 80-38, IN 94-63, IN 91-05, NRC Inspection Report 50-255/99012, IN 97-19, IN 98-11, IN 97-46, NRC Bulletin 88-08, IN 2001-05, IN 2003-11, IN 2004-11, IN 2006-27, and IN 2005-02.

Snapshot assessments of the PNPP ISI program are conducted prior to each refueling outage. The purpose of these assessments is to review the overall compliance of the PNPP Inservice Inspection (ISI) program as it pertains to regulatory and ASME Section XI Code requirements. These assessments are performed in conjunction with data gathering for the NRC inspector's "Request for Information", which identify required documentation to be reviewed during the upcoming refueling outage and is governed by NRC Inspection Procedure IP7111108G. Any potential issues identified in the Self Assessments or NRC Inspections are addressed through the site's Corrective Action Program. A review of these self-assessments performed for Refuel Outages 14 through 18 concluded that the overall health of the ISI program is satisfactory. Potential issues that were identified have been addressed, which were self-identified utilizing industry operating experience (OE) and other plant's lessons learned. Where appropriate, concerns were communicated to other work groups for use in pre-job briefings or as an awareness item. Condition reports were reviewed for trends since the previous refueling outages with none identified.

ISI program summary reports between 1989 (Cycle 1 refueling outage completed August 5, 1989) and 2021 (Cycle 18 refueling outage completed April 5, 2021), reveal compliance (including evaluation or repair of indications/flaws) and provide evidence that the program is effective for managing aging effects in accordance with the ASME Boiler Pressure Vessel Code Section XI.

From 2013 through to date, various condition reports were written to document deficiencies identified through ASME Section XI Inservice Inspections, Subsections IWB, IWC, and IWD and appropriate corrective actions have been taken accordingly.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the lnservice Inspection Program will remain effective. The continued application of proven inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

In addition, periodic self-assessments of the ASME Section XI lnservice Inspection, Subsections IWB, IWC, and IWD program are performed to identify the areas that need improvement to maintain the quality performance of the program. The program is informed and enhanced, when necessary, through the systematic and ongoing review of both plant-specific and industry operating experience.

Conclusion

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program has been demonstrated to be capable of managing cracking for components of the reactor coolant pressure boundary. The program provides reasonable assurance that the aging effects will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.4 ASME SECTION XI, SUBSECTION IWE PROGRAM

Program Description

The American Society of Mechanical Engineers (ASME) Section XI, Subsection IWE Program is an existing condition monitoring program that establishes responsibilities and requirements for conducting ASME Boiler and Pressure Vessel (B&PV) Code Section XI, Subsection IWE inspections as required by 10 CFR 50.55a and the additional requirements specified in 10 CFR 50.55a(b)(2). The program consists of examinations for accessible surface areas of containment Class MC pressure retaining components. The containment is a GE Mark III steel containment design. There are no moisture barriers, and no high strength bolting (actual measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi)) within the PNPP IWE boundary.

The program includes periodic VT-3 visual examinations of the pressure-retaining components (e.g., containment vessel and its integral attachments, containment equipment hatches, and pressure-retaining bolting, etc.) for signs of degradation, assessment of damage, and corrective actions. The program specifies acceptance criteria and expansion of the inspection scope when degradation exceeding the acceptance criteria is found. Acceptance criteria include no structural deformation or degradation such that the component’s function is impaired, no missing or detached items, erosion or corrosion of structural metal does not exceed 10% of the design wall thickness, no gross flaking, peeling, or blistering of coatings, and no excessive debris accumulation. A visual VT-1 examination is required for bolted connections when flaws or degradation are identified. IWE-1240 requires augmented examinations (Examination Category E-C) of containment surface areas subject to degradation and includes VT-1 visual examination for areas accessible from both sides, and volumetric (ultrasonic thickness measurement) examination for areas accessible from only one side.

The applicable ASME Code for the current (fourth) 10-year inspection interval for PNPP, which commenced May 18, 2019, and expires on May 17, 2029, is ASME XI, 2013 Edition, as modified by 10 CFR 50.55a or relief granted in accordance with 10 CFR 50.55a. There are currently no relief requests granted for the fourth 10-year inspection interval for components subject to the examination requirements of ASME Section XI, Subsection IWE.

In accordance with 10 CFR 50.55a(g)(4)(ii), the ASME Section XI, Subsection IWE Program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME B&PV Code specified 12 months before the start of the inspection interval. Any deviation from ASME B&PV Code, Section XI requirements must be approved by the NRC per a relief request.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The ASME Section XI, Subsection IWE Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.S1 *ASME Section XI, Subsection IWE*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the ASME Section XI, Subsection IWE Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The ASME Section XI, Subsection IWE Program consists of examinations for accessible surface areas of containment Class MC pressure retaining components. The program includes periodic VT-3 visual examinations of the pressure-retaining components for signs of degradation, assessment of damage, and corrective actions.

Review of inservice inspection summary reports (Cycle 14 through Cycle 18) and the last ten years of plant operating experience, did not reveal age-related issues that impaired intended functions with regards to containment Class MC pressure retaining components.

As reported in the inservice inspection summary report for Cycle 14 (June 7, 2011, to May 16, 2013), general visual examination of the containment and drywell interior and exterior surfaces was performed prior to and during the Cycle 14 refueling outage. Some areas of minor coating degradation were identified and documented on condition reports. None of the rusted areas exhibited any significant material loss and evaluations determined that loss of material did not exceed the allowable of 10% of the designed wall thickness.

Subsection IWE-1240 requires augmented examinations (examination category E-C) of containment surface areas subject to degradation. As noted in the ISI inspection plan, there are no areas identified for examination category E-C.

In March 2023, during a Refuel Outage 19 (1R19) examination of the Steam Tunnel Annulus, a dry, white, streaking deposit was reported on the exterior containment liner by the qualified examiner ("1R19 Inservice Inspection IWE Finding in Steam Tunnel Annulus"). The origination point appeared to be coming from above the penetrations. No active leaks were discovered during the examination. The deficiency as stated in the associated condition report met the IWL requirements acceptance criteria and required no rework. A follow up further future evaluation was referenced to the structural procedure, "*Monitoring the Effectiveness of Maintenance Structure Monitoring Program*."

From 2013 through to date, various condition reports were written to document deficiencies identified through ASME Section XI, IWE inspections and were dispositioned as appropriate.

Conclusion

The ASME Section XI, Subsection IWE Program has been demonstrated to be capable of managing aging effects of the steel containment vessel and the containment pressure retaining bolting. The continued implementation of the program provides reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.5 ASME Section XI, Subsection IWF Program

Program Description

The ASME Section XI, Subsection IWF Program is an existing condition monitoring program that meets the in-service inspection requirements specified by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section XI, as modified by 10 CFR 50.55a. The program manages aging of ASME Class 1, 2, and 3 supports. There are no Class MC supports at PNPP; containment is free-standing.

The IWF scope of inspection for supports is based on sampling of the total support population. The sample size varies depending on the ASME Class. The largest sample size is specified for the most critical supports (ASME Class 1). The sample size decreases for the less critical supports (ASME Class 2 and 3). The primary inspection method employed is VT-3 visual examination. Supports not meeting the acceptance standards of IWF-3400 are evaluated through the Corrective Action Program. Discovery of support deficiencies during regularly scheduled inspections triggers an increase of the inspection scope in order to ensure that the full extent of deficiencies is identified.

The applicable ASME Code for the current (fourth) 10 year inspection interval for PNPP, which commenced May 18, 2019, and expires on May 17, 2029, is ASME XI, 2013 Edition, as modified by 10 CFR 50.55a or relief granted in accordance with 10 CFR 50.55a. There are currently no relief requests granted for the fourth 10 year inspection interval for components subject to the examination requirements of ASME Section XI, Subsection IWF.

In accordance with 10 CFR 50.55a(g)(4)(ii), the ASME Section XI, Subsection IWF Program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified 12 months before the start of the inspection interval. Any deviation from ASME Code, Section XI requirements must be approved by the NRC per a relief request.

NUREG-1801 Consistency

The ASME Section XI, Subsection IWF Program is an existing PNPP program that, with enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.S3 *ASME Section XI, Subsection IWF*.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented in the identified program elements no later than six months prior to the period of extended operation.

Preventive Actions (Element 2)

The program will be enhanced to include preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi)).

The program will be enhanced to include preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.

The program will also be enhanced to revise plant procedures to specify the following conditions as unacceptable:

- Loss of material due to corrosion or wear that reduces the load bearing capacity of the component support.
- Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support.
- Cracked or sheared bolts, including high strength bolts, and anchors.

Parameters Monitored\Inspected (Element 3) and Detection of Aging Effects (Element 4)

The program will be enhanced to specify that, in addition to VT-3 examination, high strength bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1 inch nominal diameter, shall receive a volumetric examination in accordance with the requirements of ASME Code Section V, Article 5, Appendix IV. The representative sample size will be equal to 20 percent (rounded up to the nearest whole number) of the entire IWF population (for a given ASTM specification) of high strength bolts in sizes greater than 1 inch nominal diameter, with a maximum sample size of 25 bolts. The selection of the representative sample will consider susceptibility to stress corrosion cracking (e.g., actual measured yield strength) and ALARA principles. The frequency of examination will be once each 10-year ISI Interval.

Operating Experience

The following operating experience examples provide objective evidence that the ASME Section XI, Subsection IWF Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

ASME Section XI, Subsection IWF Program manages aging of ASME Class 1, 2, and 3 supports. There are no Class MC supports at PNPP; containment is free-standing,

Because the ASME Code is a consensus document that has been widely used over a long period, it has been shown to be effective in managing aging effects in Class 1, 2, and 3 components and their integral attachments in light-water cooled power plants.

Review of inservice inspection summary reports (Cycle 9 through Cycle 18) and the last ten years of plant operating experience, did not reveal age-related issues that impaired intended functions with regards to Class 1, 2 or 3 supports pertaining to ASME Section XI, Subsection IWF.

During the Cycle 14 refueling outage, two variable spring hangers, 1E21-H0064 and 1N11-H0229, were found to be outside of their design hot and cold settings and one, 1C41-H0068, was found to be misaligned. The two found outside their design hot and cold settings were not outside of their operable limits and the misaligned hanger was found to be within design allowances. No scope expansion was required.

In March 2013, variable spring support 1E21-H0064 was found to have a setting outside of the hot and cold settings depicted on the design drawing during an ISI exam. The condition was accepted as is and no further action was required.

In March 2013, during ISI Examination of spring support slight misalignment was found. The deficiency was evaluated in the condition report and accepted as is with no further action required.

In March 2015, High Pressure Core Spray Variable Spring Hanger 1E22-H0071 has a potential relevant operable condition requiring Engineering evaluation. Upon further evaluation, the condition was accepted as is and no further evaluation was required.

In April 2015, three springs were found outside of tolerance. A work order was initiated to correct the problem and the work was completed as planned.

In March 2019, damaged spring cans on 1B33F0060A HPU Supply and return lines were discovered. A Work order was initiated to complete the work and completed as planned.

Conclusion

The ASME Section XI, Subsection IWF Program has been demonstrated to be capable of managing aging effects of ASME Class 1, 2, and 3 supports. The continued implementation of the program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable supports will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.6 ASME SECTION XI, SUBSECTION IWL PROGRAM

Program Description

The ASME Section XI, Subsection IWL Program is an existing condition monitoring program that establishes responsibilities and requirements for conducting American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section XI, Subsection IWL inspections as required by 10 CFR 50.55a and the additional requirements specified in 10 CFR 50.55a(b)(2). The scope of the ASME Section XI, Subsection IWL Program includes reinforced concrete for the containment annulus (Class CC). Unbonded post-tensioning system is not applicable at PNPP.

PNPP’s containment vessel is a free-standing steel cylinder with an ellipsoidal dome, secured to a steel lined reinforced concrete foundation mat. The containment vessel is designed, fabricated, and erected in accordance with the requirements of the ASME Code Section III, Subsection NE, for Class MC components. At its base, in the annular region between the containment vessel and the shield building, reinforced concrete has been installed. This annulus concrete provides stiffness to the steel containment vessel to reduce the dynamic response of the steel containment vessel due to the postulated safety relief valve discharge loading phenomena. The annulus concrete is designed to the requirements of the ASME Code Section III, Division 2, Subsection CC, and Code Case N-258 - *Design of Interaction Zones for Concrete Containments Section III, Division 2*, March 1980, with proposed Revision 1.

The IWL program includes periodic visual examinations of the accessible areas of the annulus concrete. The frequency of examination is once every five years. The program specifies acceptance criteria, corrective actions, and expansion of the inspection scope when degradation exceeding the acceptance criteria is found. The program acceptance criteria for the examinations are provided in IWL-2510, which references American Concrete Institute (ACI) 201.1R and ACI 349.3R for identification of concrete degradation.

In accordance with 10 CFR 50.55a(b)(2)(viii), the program specifies additional requirements for inaccessible areas. When conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas, an evaluation of the acceptability of the concrete in the inaccessible areas is required.

The applicable ASME Code for the current (fourth) 10-year inspection interval for PNPP, which commenced May 18, 2019, and expires on May 17, 2029, is ASME XI, 2013 Edition, as modified by 10 CFR 50.55a or relief granted in accordance with 10 CFR 50.55a. There are currently no relief requests granted for the fourth 10-year inspection interval for components subject to the examination requirements of ASME Section XI, Subsection IWL

In accordance with 10 CFR 50.55a(g)(4)(ii), the ASME Section XI, Subsection IWL Program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified 12 months before the start of the inspection interval. Any deviation from ASME Code, Section XI requirements must be approved by the NRC per a relief request.

Cracking and distortion due to settlement has not been observed in containment concrete structures. Nevertheless, the ASME Section XI, Subsection IWL and the Structures Monitoring Programs continue to monitor the concrete containment structures for cracking due to any mechanism. The condition of accessible and above grade containment is used as an indicator for the condition of the inaccessible and below grade structural components and provides reasonable assurance that degradation of inaccessible structural components will be detected before a loss of an intended function.

The program, with enhancements, will be continued for the period of extended operation.

NUREG-1801 Consistency

The ASME Section XI, Subsection IWL Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.S2 *GALL ASME Section XI, Subsection IWL*.

Exceptions to NUREG-1801

None

Enhancements

The program will be enhanced to include the following ACI 349.3R requirements:

Areas of concrete deterioration and distress will be recorded in accordance with the guidance provided in ACI 349.3R.

The acceptance criteria will be based on ACI 349.3R for identification of concrete degradation. Quantitative acceptance criteria based on the "Evaluation Criteria" provided in Chapter 5 of ACI 349.3R will be used to augment the qualitative assessment of the Responsible Engineer.

The enhancements will be implemented no later than six months prior to the period of extended operation.

Operating Experience

The following operating experience examples provide objective evidence that the ASME Section XI, Subsection IWL Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The ASME Section XI, Subsection IWL Program includes periodic general visual examinations of the containment annulus accessible areas. The frequency of examination is once every five years. Areas that indicate suspect conditions receive a more detailed visual examination as applicable. Currently there are no suspect areas identified for PNPP.

As part of the Structural Maintenance Rule Program, periodic inspections of Containment Annulus and Shield Building are performed during refueling outages. A review of the Maintenance Rule Evaluation Worksheets for more than ten years concluded no adverse findings in the annulus concrete.

Review of the last ten years of plant operating experience, did not reveal age-related degradation associated with the containment annulus concrete. Similarly, no condition reports from that period were identified associated with ASME Section XI, IWL inspections.

Conclusion

The ASME Section XI, Subsection IWL Program has been demonstrated to be capable of managing aging effects of the containment annulus concrete. The continued implementation of the program, with enhancements, will provide reasonable assurance that aging effects will be managed such that the containment annulus concrete will continue to perform its intended function consistent with the current licensing basis for the period of extended operation.

B.2.7 BOLTING INTEGRITY PROGRAM

Program Description

The Bolting Integrity Program is an existing condition monitoring and preventive program that, with enhancement, will manage cracking, loss of material and loss of preload for pressure retaining bolting using preventive measures and inspection activities. The program includes preload control, selection of bolting material, use of lubricants/sealants, and performance of periodic inspections for indication of aging effects.

The general practices that are established in this program are consistent with the recommendations, as delineated in NUREG-1339, *Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*, EPRI NP-5769, *Degradation and Failure of Bolting in Nuclear Power Plants* (with the exceptions noted in NUREG-1339 for safety-related bolting) and EPRI TR-104213, *Bolted Joint Maintenance and Applications Guide*.

The program includes periodic inspection of pressure-retaining bolted joints for indication of cracking, loss of material, and loss of preload. The Bolting Integrity Program is supplemented by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, for inspection of safety-related closure bolting on pressure-retaining joints. The bolting integrity program is supplemented by the External Surfaces Monitoring of Mechanical Components Program for managing the integrity of non-ASME pressure retaining bolted joints. The integrity of non-ASME pressure-retaining bolted joints is evaluated by detection of visible leakage, evidence of past leakage, or other age-related degradation during walkdowns and maintenance activities (at least once per refueling outage). The corrective action program is used to document and manage identified leakage.

Procurement controls and installation practices, defined in plant procedures, include preventive measures to ensure that only approved lubricants/sealants (precludes the use of sulfur) are used. Bolting replacement activities include proper torquing of the bolts and checking for uniformity of the gasket compression after assembly.

The following bolting is not included in the Bolting Integrity program.

- The Primary Containment (MC) pressure-retaining bolting is managed as part of the ASME Section XI, Subsection IWE Program.
- ASME Class 1, 2, 3, and MC piping and components support bolting, including NSSS component supports, is managed as part of the ASME Section XI, Subsection IWF Program.
- Structural bolting, other than ASME Class 1, 2, 3, and MC piping and components support bolting, is managed as part of the Structures Monitoring Program, and R.G. 1.127, *Inspection of Water-Control Structures Associated with Nuclear Power Plants Program.*
- Crane and hoist bolting is managed by Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program.
- Inspection activities for bolting in a buried environment or underground with restricted access are performed in conjunction with buried piping and component inspections performed as part of the Buried and Underground Piping and Tanks Program.

- Reactor head closure bolting is managed by the Reactor Head Closure Stud Bolting Program.

NUREG-1801 Consistency

The Bolting Integrity Program is an existing PNPP program that, with enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M18 *Bolting Integrity*.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented in the identified program elements no later than six months prior to the period of extended operation.

High strength bolting (regardless of code classification) will be monitored for cracking in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-G-1. **Program Elements Affected: Preventive Actions (Element 2), Detection of Aging Effects (Element 4).**

Perform visual inspection of submerged bolting for the emergency service water pumps, diesel and motor fire pumps, emergency service water screen wash pumps and Spent Fuel Rack Grid Structure for loss of material and loss of preload on a 10 year frequency. **Program Elements Affected: Parameters Monitored/Affected (Element 3), Detection of Aging Effects (Element 4).**

Perform visual inspection of submerged bolting for the emergency core cooling systems (ECCS) and reactor core isolation cooling (RCIC) system suction strainer in the suppression pool for loss of material and loss of preload (loose or missing nuts and bolts) on a 10 year frequency. **Program Elements Affected: Parameters Monitored/Affected (Element 3), Detection of Aging Effects (Element 4).**

Acceptance criteria for high strength structural bolting shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section V, Article 5, Appendix IV. **Program Elements Affected: Parameters Acceptance Criteria (Element 6).**

Preventive measures will include using bolting material that has an actual measured yield strength limited to less than 1,034 megapascals (MPa) (150 kilo-pounds per square inch [ksi]). **Program Elements Affected: Preventive Actions (Element 2).**

Operating Experience

The following operating experience examples provide objective evidence that the Bolting Integrity Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Additional Industry OE is reflected in SLR guidance documents.

- Element 10 of NUREG-2191 includes the following OE, "SCC of A-286 stainless steel closure bolting has occurred when seal cap enclosures have been installed to mitigate gasket leakage at valve body-to-bonnet joints (NRC IN 2012-15). The enclosures surrounding the bolts filled with hot reactor coolant that had leaked from the joint and mixed with the oxygen-containing atmosphere trapped within the enclosure. The enclosures did not allow for inspections of the bolted joints." A review of this IN 2012-15 was performed by Fleet Engineering as documented under OE-2012-1413. The evaluation concluded that since PNPP does not operate with borated water, the OE would have no direct applicability.

- Element 10 of NUREG-2191 also identifies that in 2007, EPRI released report 1015337, "*Nuclear Maintenance Applications Center: Assembling Gasketed Flange Bolted Joints*." An update to this document was issued in 2016 which was evaluated by Fleet Maintenance as documented under RM-2016-0196. The associated material was provided to fleet and site training as well as mechanical superintendents for use in assembling gasketed joints.

The Bolting Integrity Program includes periodic inspection of pressure-retaining bolted joints for indication of cracking, loss of material and loss of preload and is supplemented by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, for inspection of safety-related closure bolting on pressure-retaining joints. The integrity of non-ASME pressure-retaining bolted joints is evaluated by detection of visible leakage, evidence of past leakage, or other age-related degradation during walkdowns and maintenance activities.

ISI Program summary reports between 1989 (Cycle 1 refueling outage completed August 1989) and 2021 (Cycle 18 refueling outage completed February 2021) demonstrate compliance (including evaluation or repair of indications/flaws) and provide evidence that the ASME Section XI Inservice Inspection IWB, IWC, and IWD Program is effective for managing aging effects in accordance with the ASME Boiler Pressure Vessel Code Section XI.

In the Cycle 11 refueling outage (2007), during inservice inspection of the studs for main steam isolation valve 1B21F028A, stud ISI number 18 was found to have ultrasonic indications that needed further evaluation. To meet Section XI additional examination requirements, an additional 6 studs (equal number to that scheduled for the outage) were examined and no further indications were found. Upon further investigation, it was determined that the indications for stud ISI number 18 were non-relevant (i.e., met the applicable ASME Code acceptance criteria) and no further action was required.

Table IWD-2500-1 of ASME Code Section XI provides the examination and pressure test requirements for ASME Section III Class 3 components. The fuel pool cooling, and cleanup heat exchanger (PY-0G41B0001A) is categorized as item number D3.10 which requires a

VT - 2 examination of the pressure retaining boundary. During performance of this examination in December 2008, a leak of approximately 2.0 drops per minute was identified from the flange of the heat exchanger. This leakage of a bolted connection was evaluated in accordance ASME Code Case N-566-2. The evaluation determined that the leak was not considered major nor expected to cause significant corrosion or contamination. Corrective action consisted of tightening the flange bolts to the original torque value.

Other PNPP operating experience was reviewed for license renewal. The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Bolting Integrity Program will remain effective.

Based on the above, the Bolting Integrity Program is informed and enhanced, when necessary, through the systematic and ongoing review of both plant-specific and industry operating experience.

Conclusion

The Bolting Integrity Program has been effective at managing aging effects. The continued implementation of the program, with enhancement, provides reasonable assurance that the aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.8 BURIED AND UNDERGROUND PIPING AND TANKS PROGRAM

Program Description

The Buried and Underground Piping and Tanks Program is an existing condition monitoring program that manages the loss of material, cracking, and changes in material properties of external surfaces of piping and tanks exposed to a buried environment. The program also manages the aging of the external surfaces of underground piping. The program includes protective coatings for buried piping and tanks, backfill quality, and cathodic protection as preventive measures to mitigate corrosion.

The program includes visual inspections of the pipe or tank from the exterior as permitted by opportunistic or directed excavations. If damage to the protective coatings is found and the piping surface is exposed, the pipe will be inspected for loss of material due to general, pitting, crevice, or microbiologically influenced corrosion. If corrosion has occurred, the wall thickness will be determined.

Annual ground potential surveys of the cathodic protection system are conducted to assess the effectiveness of the cathodic protection system.

Preventive measures are in accordance with standard industry practice for maintaining external coatings, wrappings, and cathodic protection.

Directed inspections of buried and underground piping are consistent with LR-ISG-2015-01 Table XI.M41-1 and its accompanying footnotes.

Directed inspections of buried tanks are also consistent with LR-ISG-2015-01 Table XI.M41-1 and its accompanying footnotes. The Fuel Oil Storage Tanks A and B, and the HPCS Fuel Oil Storage Tank are within the scope of buried tanks.

The activity of the jockey fire pump or equivalent parameter is monitored on at least a monthly interval. When unexplained changes in jockey pump activity are observed, a flow test will be conducted by the end of the next refueling outage.

Degradation or leakage found during inspections is entered into the Corrective Action Program to ensure evaluations are performed and appropriate corrective actions are taken. If adverse indications are detected, additional inspections will be performed in order to provide reasonable assurance of the integrity of the piping and tanks. The selection of components to be examined will be based on previous examination results, trending, risk ranking, and areas of cathodic protection failures or gaps, if applicable. Additional sampling continues until reasonable assurance of intended function of the subject components is provided.

Directed inspections are conducted during each 10-year period beginning 10 years prior to the period of extended operation and continued through the period of extended operation.

NUREG-1801 Consistency

The Buried and Underground Piping and Tanks Program is an existing PNPP program that, after enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M41 *Buried and Underground Piping and Tanks,* and revised by LR-ISG-2015-01.

Exceptions to NUREG-1801

None

Enhancements

Procedures will be enhanced to describe the PNPP-program:

- Identify the systems containing buried or underground piping within the scope of license renewal.
- Describe opportunistic inspections.
- Describe cathodic protection.

- Describe fire jockey pump monitoring.
- Describe the directed underground and buried inspections.

The enhancement will be implemented no later than six months prior to the period of extended operation.

Operating Experience

The following operating experience review provides objective evidence that the Buried and Underground Piping and Tanks Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The review process of plant-specific and industry operating experience since 2013 has been documented. A thorough search of plant Corrective Action Program documents and industry OE found few instances of operating experience related to cathodic protection, jockey pump cycling, or underground leaks. The industry experience is bounded by the guidance of NUREG-1801. All plant specific instances were promptly corrected through the Corrective Action Program.

- A work order completed in June 2013 (Refuel Outage 14) internally inspected, by remote camera, Emergency Service Water piping. No evidence of leaking through wall was found,
- In June 2014 a Condition Report (CR) documented a water leak south of fire hydrant 37. The leak was isolated, 8" PVC pipe and Hydrant 37 were replaced, MIC inspection found no evidence of MIC. Coating applied to flanges and fasteners. Post maintenance testing was completed successfully.
- In January 2020 a CR documented the fire service jockey pump was cycling on too frequently. Fire Jockey pump off time of 7 minutes is less than the minimum expected off time of 10 minutes. Found the motor fire pump discharge check valve was leaking by. Replaced the valve.
- In October 2020 a CR documented a sink hole forming. A P54 fire water leak was suspected. Excavation found the leak to be from construction bathroom piping. Replaced section of pipe. Backfilled the excavation.

The regularly scheduled underground and buried piping and tanks inspections identified no significant instances of aging mechanisms.

- In November 2013 a CR documented Condensate Transfer & Storage (P11) pipe coating to be degraded and disbonded during a planned excavation. Inspection and testing of P11 and Emergency Service Water (P45) piping found that the coating on the 4" P11 piping came off with the dirt and sand, about 5' of piping outside the "area of interest." Some general pitting and corrosion was observed and removed. Wall thickness was evaluated, and the piping was approved for continued operation. Post maintenance testing was completed successfully.

Operating experience demonstrates that the Buried and Underground Piping and Tanks Program effectively manages loss of material, cracking, and changes in material properties of external surfaces of piping and tanks exposed to a buried environment.

Conclusion

The Buried and Underground Piping and Tanks Program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.9 BWR Control Rod Drive Return Line Nozzle Program

Program Description

The BWR Control Rod Drive Return Line Nozzle Program is an existing condition monitoring program that manages the aging effect of cracking in the control rod drive return line (CRDRL) nozzle.

Prior to initial operation, the Control Rod Drive System was modified to eliminate the return line to the reactor vessel and the CRDRL nozzle was capped. Therefore, augmented inspections required by NUREG-0619, *BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A 10*, are not applicable.

The program performs in-service inspections to monitor the effects of cracking of the CRDRL nozzle. The CRDRL nozzle-to-vessel weld and the nozzle inner radius volumetric ultrasonic test (UT) examinations are performed at the frequency specified in ASME Section XI (2013 Edition), Subsection IWB, Table IWB-2500-1, Examination Category B-D. The CRDRL nozzle to safe-end and the nozzle safe-end-to-cap weld visual (VT-2) inspections are performed during the reactor pressure test performed each refueling outage.

Plant procedures require that flaw indications are evaluated in accordance with the guidelines of ASME Section XI, IWB-3100.

NUREG-1801 Consistency

The BWR Control Rod Drive Return Line Nozzle Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M6, *BWR Control Rod Drive Return Line Nozzle*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the BWR Control Rod Drive Return Line Nozzle Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Industry Operating Experience

NUREG-0619, "*BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10 (Technical Report)*", summarized the BWR CRDRL nozzle operating experience through its issuance in 1980, which revealed a history of BWR plants experiencing cracking in the CRDRL nozzles. NUREG-0619 provided several recommendations for inspections and design improvements. The implementation of these recommendations industry-wide has resulted in a reduction of the observed CRDRL nozzle cracking.

NRC Information Notice 2004-08, "*Reactor Coolant Pressure Boundary Leakage Attributable to Propagation of Cracking in Reactor Vessel Nozzle Welds*," provided information on leakage from the CRDRL nozzle-to-cap weld area. The cause of condition was determined to be cracking due to dissimilar weld materials. The staff found that the affected plant had mitigating procedures, routine inspection activities, operable leakage detection equipment and Technical Specification requirements designed to detect low levels of leakage from the reactor coolant system and to minimize the potential that a flaw could remain undetected. On that basis, the staff determined, qualitatively, that the CRDRL pressure boundary leakage was of very low safety significance.

PNPP Operating Experience

The CRDRL nozzle welds and inner radius were inspected in accordance with the BWR Control Rod Drive Return Line Nozzle Program during the 1991, 2001, 2013, 2017, and 2019 refueling outages. No indications were identified during these inspections.

The combination of the use of operating experience-based industry standard inspection methods and the plant specific operating experience provides assurance that the BWR Control Rod Drive Return Line Nozzle Program inspections will provide timely indication of detection of cracking if it occurs.

Conclusion

The BWR Control Rod Drive Return Line Nozzle Program has been demonstrated to be effective at managing cracking of the CRDRL nozzle. The program provides reasonable assurance that the aging effects will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.10 BWR FEEDWATER NOZZLE PROGRAM

Program Description

The BWR Feedwater Nozzle aging management program is an existing condition monitoring program that manages the aging effect of cracking in the reactor vessel feedwater nozzles. The feedwater nozzles are exposed to a reactor coolant environment. The program manages examination of feedwater nozzles in accordance with the requirements of ASME Code, Section XI and of NUREG-0619, Revision 1, *BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10 (Technical Report)*, as modified by the BWR Owners Group Licensing Topical Report, GE-NE-523-A71-0594-A, Revision 1, *Alternate BWR Feedwater Nozzle Inspection Requirements*.

The program is implemented through the plant inservice inspection (ISI) program and specifies periodic ultrasonic test (UT) examination of critical regions of the feedwater nozzles. The inspections are performed each 10-year inservice inspection interval.

NUREG-0619 was issued prior to PNPP start up allowing its design recommendations to be incorporated before initial operation. The PNPP feedwater nozzles do not include cladding on the nozzle inner surface and use a triple thermal sleeve feedwater nozzle design. The reactor water cleanup system returns flow to both feedwater loops, so flow is directed to all feedwater spargers. The control rod drive return line has been capped. The feedwater system is equipped with a low flow feedwater control valve to minimize flow fluctuations during low power operations.

Flaw indications are evaluated in accordance with ASME Code, Section XI. Inspection results that do not satisfy the acceptance criteria are documented in accordance with the corrective action program.

NUREG-1801 Consistency

The BWR Feedwater Nozzle Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M5, *BWR Feedwater Nozzle*, with the following exception.

Exceptions to NUREG-1801

NUREG-1801 states that the inspection schedule for the feedwater nozzles should in accordance with Table 6-1 of GE NE-523-A71-0594, Rev. 1. Note (2) of this table states, in part, that in no case shall the maximum allowable time between inspections exceed 10 years. PNPP will perform examinations of a minimum of 25 percent of the population of the feedwater nozzle inner radii each inspection interval.

Program Elements Affected: Detection of Aging Effects (Element 4) and Monitoring and Trending (Element 5)

Justification for Exception

By letter dated January 5, 2022 (ML22006A167), PNPP submitted to the NRC Request IR-063, which requested, in part, to perform examinations of a minimum of 25 percent of the population of the feedwater nozzle inner radii using volumetric inspection methods each inservice inspection interval in lieu of 100 percent of the population.

EPRI Technical Reports BWRVIP-108-A and BWRVIP-241-A contain the technical basis supporting ASME Code Case N-702, “Alternative Requirements for Boiling Water Reactor Nozzle Inner Radius and Nozzle-to-Shell Welds, Section XI, Division 1” for reducing the inspection of RPV nozzle-to-vessel welds and nozzle inner radius regions from 100 percent of the population of the nozzles to 25 percent of the population of nozzles for each nozzle type during each 10-year ISI interval. However, the reports and Code Case N-702 explicitly exclude reactor feedwater nozzles stating that these nozzles are managed under a separate mandated program directed by NUREG-0619, “BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10 (Technical Report).” The request proposed that the feedwater nozzle-to-vessel welds and inner radii examinations mandated under NUREG-0619 be subsumed by the current ASME Section XI requirements and the number of inspections reduced based on this relief request.

In the NRC SER for approval of the relief request (ML22006A167), the staff noted that PNPP’s “statements and bases in this regard to be accurate because they are consistent with the staff’s basis for sunsetting NUREG-0619 augmented inspection criteria for RFW nozzles in NRC NUREG-2221, *Technical Bases for Changes in the Subsequent License Renewal Documents NUREG-2191 and NUREG-2192*, December 2017 (ML17362A126), and for eliminating Generic Aging Lessons Learned [GALL] Aging Management Program [AMP] XI.M5, *BWR Feedwater Nozzles*, in Tables 2-17 and 2-29 of NUREG-2191, Volumes 1 and 2, *Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report*, July 2017 by letter dated September 30, 2022.”

The NRC SER for IR-063 stated that the NRC staff authorizes the use of proposed alternative IR-063 at PNPP for the remainder of the current fourth 10-year ISI interval that started on May 18, 2019, and ends on May 17, 2029 (recognizing that the existing 40-year license expires November 7, 2026). It is understood that prior to entering the subsequent 10-year ISI intervals, PNPP would have to either comply with the ASME Code requirements or request relief from the requirements consistent with what PNPP has done during the initial operating period.

In NUREG-2191, the NUREG-1801 XI.M5 program has been incorporated into the XI.M1 Inservice Inspection, IWB, IWC and IWD program .Relief Request IR-063 produces the same net effect for PNPP with regards to the inspections of the feedwater inner radii.

Enhancements

None

Operating Experience

The following industry and plant operating experience examples provide objective evidence that the BWR Feedwater Nozzle program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis for the period of extended operation.

Industry Operating Experience

NUREG-0619, *BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10 (Technical Report),* summarized the BWR feedwater nozzle operating experience through its issuance in 1980, which revealed a history of BWR plants experiencing cracking in the feedwater nozzles and connecting feedwater spargers. NUREG-0619 provided several recommendations for inspections and design improvements. The implementation of these recommendations industry-wide has resulted in a reduction of the observed feedwater nozzle cracking.

BWR Owners Group Licensing Topical Report GE-NE-523-A71-0594-A, Revision 1, *"Alternate BWR Feedwater Nozzle Inspection Requirements",* issued in 1999, evaluated the industry operating experience with feedwater nozzle cracking and the improvement in inspection techniques since the issuance of NUREG-0619. The report provided alternate inspection scope, methodology and schedule recommendations for the inspection of the feedwater nozzles based on this information. The recommendations were accepted by the NRC as a substitute for those set forth in NUREG-0619. Consistent with recommendations of GE-NE-523-A71-0594-A, Rev. 1, the feedwater nozzles inspections are ultrasonic test examinations of the feedwater nozzle inner radius at the critical locations -- NUREG-0619 zones 1, 2A, 2B, 3, 4A, 4B and 5.

PNPP Operating Experience

The feedwater nozzles have been inspected for cracking as part of the existing augmented ISI program in accordance with the guidance in GE-NE-523-A71-0594-A, Revision 1. The feedwater nozzles were first inspected using the UT techniques recommended within GE-NE-523-A71-0594-A, Revision 1 during PNPP's second refueling outage in 1991. Subsequently, each nozzle has been inspected at least twice. The most recent inspection was during PNPP's fourteenth refueling outage in 2013.

During the initial inspection in 1991, flaws exceeding the acceptance criteria of ASME Code, Section XI, Article IWB-3600 were found in two feedwater nozzle to safe-end welds. These flaws were evaluated and determined to be acceptable for continued service. The flaws were mechanically stress improved and re-inspected during the third refueling outage (1992) and subsequently re-inspected during the fifth refueling outage (1996). The flaws were found to be unchanged. Prior to the seventh refueling outage (1999), the flaws were re-evaluated using newer industry sizing procedures and analysis software. These newer methodologies identified that one of the flaws was significantly deeper than previously determined. As a result of this new evaluation, a full strength weld overlay repair was performed. Subsequent inspections of this repair have identified no flaw growth.

The fourth refueling outage (1994) inspections revealed corner flaws in two nozzles. The flaws were evaluated in accordance with ASME Code, Section XI, Article IWB-3600 and determined to be acceptable for continued service. Re-inspections were scheduled in accordance with Article IWB-2420. Further evaluation of the flaws following the outage, determined that these were non-relevant indications.

The combination of the use of operating experience-based industry standard inspection methods and the plant specific operating experience provides assurance that the BWR Feedwater Nozzle program inspections will provide timely indication of detection of cracking if it occurs.

Conclusion

The BWR Feedwater Nozzle Program has been demonstrated to be capable of managing cracking of the BWR feedwater nozzles. The program provides reasonable assurance that the aging effects will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.11 BWR Penetrations Program

The BWR Penetrations Program is an existing condition monitoring program that manages the effects of cracking of the reactor vessel instrumentation penetrations, standby liquid control (SLC) nozzles/Core ΔP nozzles, and control rod drive (CRD) housing and incore-monitoring housing penetrations exposed to reactor coolant through inspections and water chemistry. The subject components are inspected in accordance with the requirements of the ASME Code, Section XI. The BWR Penetrations Program incorporates the inspection and flaw evaluation recommendations of BWRVIP-27-A, *BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines,* BWRVIP-47-A, *BWR Lower Plenum Inspection and Flaw Evaluation Guidelines,* and BWRVIP-49-A, *Instrument Penetration Inspection and Flaw Evaluation Guidelines.* The reactor water chemistry is controlled and monitored as described in the Water Chemistry Program.

Indications are evaluated consistent with the ASME Code, Section XI, Subsection IWB-3500 and the additional guidance provided in BWRVIP-27-A, BWRVIP-47-A, and BWRVIP-49-A. If flaws are found, the scope of the inspection is expanded in accordance with the guidance provided in the ASME Code, Section XI. Repair and replacement procedures comply with the requirements of ASME Code, Section XI.

NUREG-1801 Consistency

The BWR Penetrations Program is an existing PNPP program that with enhancement, is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M8, *BWR Penetrations*.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be completed no later than 6 months prior to entering the period of extended operation:

The inservice inspections procedures will be revised to incorporate BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively. **Program Element Effects: Monitoring and Trending (Element 5).**

Operating Experience

The following industry and plant operating experience examples provide objective evidence that the BWR Penetrations Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

<u>Industry Operating Experience</u>

BWRVIP-27-A, BWRVIP-47-A, and BWRVIP-49-A evaluated the industry operating experience with cracking of the instrumentation nozzles, the CRD housing and incore-monitoring housing penetrations, and the SLC nozzles/Core ΔP nozzles. The report provided inspection scope, methodology, schedule, and evaluation recommendations for the inspection of these penetrations and nozzles based on this information. Implementation of these recommendations provide reasonable assurance that cracking will be adequately managed.

<u>PNPP Operating Experience</u>

Examinations of the CRD guide tube sleeve-to-alignment lug welds, body-to-sleeve welds, base-to-body welds, and fuel support alignment pin-to-core plate welds were completed during the 1995, 2001, 2005, and 2007 refueling outages. No unacceptable indications were identified during these inspections.

The instrumentation nozzles, the CRD housing and incore-monitoring housing penetrations, and the SLC nozzles/Core ΔP nozzles are subject to a VT-2 leakage inspection during the system leak test each refueling outage. No leakage of these penetrations or nozzles has been identified during those inspections.

The combination of the use of operating experience-based industry standard inspection methods and the plant specific operating experience provides assurance that the BWR Penetrations Program inspections will provide timely indication of detection of cracking if it occurs.

Conclusion

The BWR Penetrations Program has been demonstrated to be capable of managing cracking of the reactor vessel instrumentation nozzles, the CRD housing and incore-monitoring housing penetrations, and the SLC nozzles/Core ΔP nozzles. The program, with enhancement, will provide reasonable assurance that the aging effects will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.12 BWR Stress Corrosion Cracking Program

Program Description

The BWR Stress Corrosion Cracking Program is an existing condition monitoring and mitigation program that manages intergranular stress corrosion cracking (IGSCC) in reactor coolant pressure boundary piping and piping components made of stainless steel and nickel-based alloy in a reactor coolant environment. The program implements the program delineated in NUREG-0313, Revision 2, *Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping* and NRC Generic Letter (GL) 88-01, *NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping*, including Supplement 1. The program includes preventive measures to mitigate IGSCC, and inspection and flaw evaluation to monitor IGSCC and its effects.

Reactor coolant water chemistry is controlled and monitored as described in the Water Chemistry Program. Hydrogen Water Chemistry and Noble Metals Chemical Addition have been implemented to further reduce susceptibility of the piping systems exposed to reactor coolant to IGSCC. Mechanical Stress Improvement Process (MSIP) or weld overlay has been performed on several welds determined to be susceptible to IGSCC.

The BWR Stress Corrosion Cracking Program is implemented through the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The inspection frequency for welds is in accordance with NRC GL 88-01, including Supplement 1, as modified by BWRVIP-75-A, *BWR Vessel and Internals Project Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules*.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The BWR Stress Corrosion Cracking Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M7, *BWR Stress Corrosion Cracking*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the BWR Stress Corrosion Cracking Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Industry Operating Experience

NUREG-0313, Revision 2, and NRC Generic Letter (GL) 88-01 evaluated the industry operating experience with IGSCC and the inspection techniques appropriate to detecting the observed cracking. The NRC staff provided inspection scope, methodology, schedule, and evaluation recommendations for the inspection of BWR piping and piping welds made of austenitic SS and nickel alloy based on this information. These recommendations enhanced the inspections performed in accordance with ASME Code, Section XI.

As result of these recommendations, PNPP selected materials resistance to IGSCC; used solution heat treatment and stress improvement processes to provide additional resistance to IGSCC; and modified the extent, schedule, and examination methods for the in scope components.

PNPP Operating Experience

Prior to the 1999 refueling outage, a review of the 1996 refueling outage data with new analysis techniques, identified a flaw on the nozzle to safe-end weld of one of the feedwater nozzles. The as found inspection during the 1999 refueling outage indicated that the flaw size had not changed. A weld overlay was applied to the feedwater nozzle. The overlay is designed as a full structural overlay in accordance with the recommendations of NUREG-0313, Revision 2, ASME Code Case N-504, and Section XI of the ASME Code, 1989 Edition. A follow up inspection during the 2001 refueling outage and a scheduled inspection during the 2013 refueling outage of this repair have identified no flaw growth.

On May 9, 2016, EPRI issued NDE Alert Letter NDE 20160509-001, which addressed industry operating experience related to dissimilar metal weld (DMW) examination of mitigated Alloy 600/82/182 weld with the MSIP. Based on the operating experience, the letter requested that any plants which have Code Case N-770-1 Inspection Item E or GL 88-01 Category E welds which have not been repaired or overlaid, and that have not been examined utilizing revision 1 of the EPRI guidance, should have the data reviewed to ensure adequate data quality was achieved and that the flaws were appropriately sized. PNPP had one Category E weld which had not been repaired or overlaid. This weld had been examined during the 2013 refueling outage. Since the personnel performing the examination knew of the industry operating experience and the pending EPRI NDE Alert, an effort was made to complete the examination consistent with the expected guidance. Once the EPRI NDE Alert was issued, a gap analysis was performed to determine if the examination was in fact consistent with the guidance. The gap analysis determined that the 2013 examination met the requirements of the “needed” and “good practice” requirements of the EPRI NDE Alert Letter.

Conclusion

The BWR Stress Corrosion Cracking Program has been demonstrated to be capable of managing cracking of the reactor coolant pressure-retaining components. The program provides reasonable assurance that the aging effects will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.13 BWR VESSEL ID ATTACHMENT WELDS PROGRAM

Program Description

The BWR Vessel ID Attachment Welds Program is an existing condition monitoring program that manages cracking in structural welds for BWR reactor vessel internal integral attachments using inspection and flaw evaluation. The program is implemented through station procedures that provide for condition monitoring through in-vessel examinations of the reactor vessel internal attachment welds in accordance with the requirements of ASME Section XI, Subsection IWB, Examination Category B-N-2 enhanced consistent with the inspection and evaluation guidelines of BWRVIP-48, *BWR Vessel and Internals Project Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines*.

The scope of the program includes the steam dryer support and hold down bracket attachment welds, guide rod bracket attachment welds, feedwater sparger bracket attachment welds, jet pump riser brace leaf/arm attachment welds, core spray piping bracket attachment welds, and sample holder welded attachment.

Indications are evaluated consistent with ASME Code, Section XI, Subsections IWB-3500 and IWB-3600 and the additional guidance provided in BWRVIP-48. If flaws are found, the scope of the inspection is expanded in accordance with the guidance provided in BWRVIP-48. Repair and replacement procedures comply with the requirements of ASME Code, Section XI.

NUREG-1801 Consistency

The BWR Vessel ID Attachment Welds Program is an existing PNPP program that will be consistent, with enhancement, with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M4, *BWR Vessel ID Attachment Welds*, with the following exception.

Exceptions to NUREG-1801:

The BWR Vessel ID Attachment Welds Program is based on the requirements of BWRVIP-48,R1 in lieu of BWRVIP-48-A. Since BWRVIP-48, R1 is not staff approved this is an exception to the NUREG-1801 AMP. **Program Elements affected: Detection of Aging Effects (Element 4), and Monitoring And Trending (Element 5).**

Justification for Exception:

By letter date January 6, 2020, PNPP submitted 10 CFR 50.55a Request IR-056, Rev. 3. This request proposed to apply specific BWRVIP guidelines to affected ASME Code components in lieu of the requirements of ASME Code, Section XI, Paragraph IWB-2500(a) and Table IWB-2500-1, including the examination method, examination volume, frequency, training, successive and additional examinations, flaw evaluations, and reporting. One of the specific BWRVIP guidelines included in IR56 was BWVIP-48, R1. The NRC responded by letter dated January 29, 2021, and accepted the use of the identified BWRVIP guidelines, including BWRVIP-48, R1, in lieu of the ASME Code requirements. The NRC letter, which accepted IR-56, explicitly authorized the use of the proposed alternative the relief request for fourth 10-year ISI interval, which began on May 18, 2019, and is scheduled to expire on May 17, 2029. It is understood that prior to entering the subsequent 10-year ISI intervals, PNPP would have to either comply with the ASME Code requirements or request relief from the requirements consistent with what PNPP has done during the initial operating period.

It is recognized that BWRVIP-48, R1 has not been generically approved by the NRC staff. However, the use of this revision has been approved for use by PNPP, in accordance the NRC approval of IR-56.

Enhancements

No later than 6 months prior to entering the period of extended operation the following enhancement will be completed:

The inservice inspections procedures will be revised to incorporate BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively. **Program Elements Effected: Monitoring and Trending (Element 5).**

Operating Experience

The following operating experience examples provide objective evidence that the BWR Vessel ID Attachment Welds Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Industry Operating Experience

BWRVIP-48-A evaluated the industry operating experience with attachment weld cracking and the inspection techniques appropriate to detecting the observed cracking. The report provided inspection scope, methodology, schedule, and evaluation recommendations for the inspection of the vessel ID attachment welds based on this information. These recommendations enhanced the inspections performed in accordance with ASME Code, Section XI. The recommendations were accepted by the NRC as a substitute for the ASME Code, Section XI inspections.

PNPP Operating Experience

Examinations of the vessel ID attachment welds have been performed using the specified inspection techniques as shown in Table B.2.13-1. No reportable indications were identified during these inspections.

Table B.2.13-1 Vessel ID Attachment Weld Inspections

Location	EVT-1	VT-3	VT-1	MTV-1
Core Spray Piping	2017, 2019	2009)		
Jet Pump Riser	2007	1996, 2017, 2019	1994 2001, 2013	
Guide Rod		1996, 2009, 2017, 2019		
Steam Dryer Support	2001	1989, 2011, 2017, 2019		
Steam Dryer Holddown		1989, 2001, 2011, 2017, 2019		

Feedwater Sparger	2011, 2017, 2019	1996, 2011		1999
Surveillance Sample Holder		2017, 2019	1996, 2009	

The combination of the use of operating experience-based industry standard inspection methods and the plant specific operating experience provides assurance that the BWR Vessel ID Attachment Welds program inspections will provide timely indication of detection of cracking if it occurs.

Conclusion

The BWR Vessel ID Attachment Welds Program has been effective at managing aging effects. The BWR Vessel ID Attachment Welds Program, with enhancement, will provide reasonable assurance the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.2.14 BWR VESSEL INTERNALS PROGRAM

Program Description

The BWR Vessel Internals Program is an existing condition monitoring program that includes inspection and flaw evaluation in accordance with the requirements of ASME Code, Section XI and Boiling Water Reactor Vessel and Internals Project (BWRVIP) reports. The program manages the effects of cracking, loss of material and loss of fracture toughness of vessel internal components in a reactor coolant or steam environment. Reactor coolant water chemistry is controlled and monitored to maintain high water purity and reduce susceptibility to stress corrosion cracking (SCC) or intergranular stress corrosion cracking (IGSCC) as described in the Water Chemistry Program.

The BWR Vessel Internals Program incorporates the inspection and flaw evaluation (I&E) recommendations and the repair design criteria guidelines for the in-scope components as identified in the following listing:

In-Scope Component	Applicable I&E BWRVIP	Applicable Repair BWRVIP
Core Shroud	BWRVIP-76, R-1-A	BWRVIP-02-A

Core Plate	BWRVIP-25, R-1-A	BWRVIP-50-A
Core Spray	BWRVIP-18, R-2-A	BWRVIP-16-A; BWRVIP-19A
Shroud Support	BWRVIP-38	BWRVIP-52-A
Jet Pump Assembly	BWRVIP-41, R-4-A; BWRVIP-138, R-1-A	BWRVIP-51-A
Low Pressure Core Injection Couplings	BWRVIP-42, R-1-A	BWRVIP-56-A
Top Guide	BWRVIP-26-A BWRVIP-183-A	BWRVIP-50-A
Control Rod Drive Housing	BWRVIP-47-A	BWRVIP-58-A
Lower Plenum Components	BWRVIP-47-A	BWRVIP-57 R-1
Steam Dryer	BWRVIP-139, R-1-A	BWRVIP-181 R-2
Access Hole Cover	BWRVIP-180 R-1	BWRVIP-217
Orificed Fuel Support	BWRVIP-47-A	N/A

The BWR Vessel Internals Program indirectly manages the loss of fracture toughness due to neutron or thermal embrittlement of cast austenitic stainless steel (CASS) and Alloy X-750 materials. The program relies on the assessment of the susceptibility of the CASS component materials for thermal aging and neutron irradiation embrittlement performed in BWRVIP-234-A and the assessment of the X-750 component materials in BWRVIP-138-A.

NUREG-1801 Consistency

The BWR Vessel Internals Program is an existing PNPP program that, with enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M9, *BWR Vessel Internals*.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be completed no later than 6 months prior to the period of extended operation:

The BWR Vessel Internals Program implementing station procedures will be revised to incorporate BWRVIP-14, BWRVIP-59, and BWRVIP-60 as guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively. **Program Element Affected: Monitoring and Trending (Element 5).**

An evaluation of the 60-year fluence for the six (6) critical components identified in BWRVIP-234, Table 6-1, will be performed to verify the applicability of the BWRVIP to PNPP. In the unlikely circumstance that the 60-year fluence limits for one or more these components are exceeded, an assessment of the susceptibility of reactor vessel internal components fabricated from CASS to loss of fracture toughness due to thermal aging and neutron irradiation embrittlement will be performed. The required periodic inspections of CASS components determined to be susceptible to loss of fracture toughness due to thermal aging and neutron irradiation embrittlement will be determined based on this assessment. **Program Elements Affected: Scope of Program (Element 1) and Acceptance Criteria (Element 6)**

Operating Experience

The following examples of operating experience provide objective evidence that the BWR Vessel Internals Program will continue to be effective in assuring that intended functions are maintained consistent with the current licensing basis during the period of extended operation.

<u>Core Spray Piping and Spargers</u>

Baseline examinations were performed during 1996 and 1997 refueling outages using the applicable visual techniques and continued during each subsequent refueling outage.

No indications, except as noted below, were found during these inspections.

During 2010 refueling outage inspections, a cracked tack weld was found on one of the bolts for the high pressure core spray shroud connection. In accordance with BWRVIP-18, cracking of a tack weld is not considered to be a detrimental condition and the location need not be evaluated as a flawed location unless the nature of the cracking challenges the anti-rotation function of the weld. During the Cycle 14 refueling outage (2013), a follow-up condition monitoring examination was performed on the cracked tack weld as part of the regularly scheduled inspections.

The inspection found no changes in the condition of the cracked tack weld and that there was no evidence of loss of bolt tightness or integrity.

<u>Top Guide</u>

The ASME Code baseline visual inspections of the top guide assembly studs and tack welds were performed during the 1989 refueling outage and repeated during the 1999 refueling outage. Inspections during the 2011, 2017, and 2019 refueling outages were in accordance with both the ASME Code and BWRVIP-26 requirements.

The top guide assembly welds were visually inspected in accordance with the ASME Code during the 1999 refueling outage. Subsequent inspections of the top guide grid beam welds and cells during the 2011, 2017, and 2019 refueling outages were consistent with the ASME Code and BWRVIP-183.

No indications were identified during these inspections.

Shroud Support

Two core shroud support welds are periodically inspected as part of the program. The baseline visual inspection of the H-8 and H-9 welds were performed during the 1999 refueling outage. Subsequent visual inspections of the H-8 weld occurred during 2005, 2011, 2017, 2019 refueling outages. A baseline UT exam of the H9 weld was performed during the 2005 refueling outage. Subsequent inspections included visual inspections during the 2017, and 2019 refueling outages and a UT inspection during the 2015 refueling outage.

Inspections below the core plate are performed on a “best effort” basis when maintenance or repair activities provide access. During the 2007 and 2011 refueling outages, the accessible portions of the H8 and H9 welds were visually examined below the core plate.

Since BWRVIP-38 does not require inspection of the shroud support leg welds, these welds are inspected on an as accessible basis. Visual inspections of the welds were performed during the 2001, 2007 and 2011 refueling outages.

No indications were identified during these examinations.

Jet Pumps

Jet pump holddown beams – Baseline UT examinations were performed during the 2003 refueling outage. UT examinations of the beams were also performed during the 2009 and 2019 refueling outage. No indications were identified.

Jet pump assembly welds – Visual inspections of the jet pump assembly welds were performed during the 1994, 1998, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017 and 2019 refueling outages.

No indications were identified.

Low Pressure Coolant Injection (LCPI) Couplings

Baseline visual inspections consistent with the BWRVIP-42 requirements were performed during the 1999 refueling outage. Re-examinations were performed during the 2003, 2007, 2011, 2015, 2017 and 2019 refueling outages. No indications were identified.

Lower Plenum/CRD Tubes

The operating experience for the lower plenum/CRD tubes is addressed in the aging management program, XI.M8, *BWR Penetrations*.

Core Shroud

Baseline examinations were performed using UT methods in the 1999 refueling outage. The re-examination of the core shroud welds during the 2005 refueling outage identified minor cracking (i.e., less than 10% through wall and less than 10% of the inspected length) in the shroud lower cylinder to shroud support cylinder weld. The indications were present in the 1999 refueling outage examination data but were identified as geometry. The length of the indications was unchanged.

During the 2015 refueling outage, the welds were examined using UT techniques and the same indications were identified. The length of the indications was unchanged from the 2005 refueling outage and the cracks remained less than 10% through wall. The indications were documented in a condition report and the need to revise the inspection schedule was evaluated. The evaluation determined that the welds did not need to be re-examined for 10 years.

During the 2017 and 2019 refueling outages visual inspections were performed on the core shroud welds. No indications were identified.

No indications were identified during these examinations.

Dry Tubes

On April 2012, an industry evaluation identified that insufficient attention was being paid to the potential for IASCC in dry tubes. As a result of this information, PNPP evaluated its approach to inspection and replacement the dry tubes and issued a Dry Tube Replacement Action Plan. PNPP had already replaced 6 dry tubes during the 2011 refueling outage. This plan called for the replacement of the remaining original dry tubes by 2017.

On March 2015, PNPP experienced a brittle fracture of a dry tube during a planned cutting and crimping activity. The apparent cause of the failure was determined to be embrittlement due to aging of the dry tubes. An evaluation of the dry tube embrittlement determined no emergent replacement activity was necessary during the 2015 refueling outage and that the aged dry tubes are expected to be brittle, as discussed in SIL-409, but without cracking being present the likelihood of fracture is low. By that time, PNPP had replaced 12 dry tubes and planned to replace 6 more each refueling outage until all the original dry tubes were replaced.

Based on a 2015 industry evaluation, PNPP re-evaluated the dry tube replacement schedule and determined that all remaining original dry tubes should be replaced by the 2021 refueling outage. As of the end of the 2021 refueling outage, PNPP had 25 original dry tubes to be replaced. Twelve dry tubes will be replaced during each of the 2023 and 2025 refueling outages. The last remaining original dry tube will be replaced during the 2027 refueling outage.

Steam Dryer

The ASME Category B-N-I visual examination of the accessible reactor vessel interior surfaces during the 2003 refueling outage identified deposits of very hard materials on the stainless steel cladding of the upper regions of the vessel interior adjacent to the main steam nozzles. The deposits were later found to also be located on corresponding areas of the steam dryer. The deposits were documented in a condition report and evaluated as acceptable for continued operation under the condition report's root cause evaluation. Follow up inspections were performed during the 2005 and 2007 refueling outages and determined that there was no change to the deposits.

The baseline BWRVIP-139 inspection of the steam dryer welds was performed in the 2009 refueling outage. Indications were noted for lifting lug bracket welds, lifting lugs, lifting lower guide and support ring. Condition reports were written and evaluated for each of these indications.

The lifting lug bracket, lifting lugs, and lower guide bracket were determined to be relatively minor indications that were dispositioned within their respective condition report. Based on the BWRVIP-139 guidance the lifting lugs and lifting lug bracket indications were scheduled for three subsequent inspections to demonstrate that the indications had "stabilized." For the lower guide, the evaluation determined that re-inspection was not required because the guide is bent and the indication was not really a linear indication, which is what the BWRVIP-139 reinspection guidance was written for. The damage that caused the lower guide to become bent is not expected to reoccur, so the bracket was not expected to continue to bend.

The upper support ring was found to have various IGSCC type indications. BWRVIP-139 provided guidance necessitates reinspection until it can be shown the indication has "stabilized." The IGSCC was expected to gradually worsen and not arrest in development. The upper support ring was scheduled for re-inspection every refueling outage. These inspections will continue unless the indications do arrest and no new ones are found. If this occurs the requirement for reinspection every refueling outage would be re-evaluated.

The follow-up inspections were performed in the 2011, 2013, 2015 refueling outages. The inspections of the lifting lug bracket and lifting lugs found no change in the indications during these re-inspections. The re-inspections identified that the IGSCC indications on the upper support ring slightly increased in number and size. Evaluation determined that the steam dryer remained structurally sound and was fit for continued operation. Continued monitoring through subsequent exams was determined to be warranted.

Inspections of the upper support ring continued during the 2017 and 2019 refueling outages. The inspections determined that there was no discernible change to the longest linear indication.

During the 2021 refueling outage, a new baseline inspection of the steam dryer was performed with all the 2009 baseline inspection locations being re-inspected. No discernible change was identified to any of the indications identified in the 2021 inspections. An evaluation determined that inspection of the hard deposits identified in

2003 no longer need to be performed since the deposits do not affect steam dryer performance and are not required by BWRVIP or any other guidance.

Access Hole Cover

The access hole cover was visually inspected during the 1996 refueling outage.

The BWRVIP-180 baseline inspection using enhanced visual techniques was performed during the 2007 refueling outage. Access hole cover inspections were performed during the 2013, 2017 and 2019 refueling outages. No indications were identified during these inspections.

Orificed fuel support

The orificed fuel support was visually inspected during the 1989 and 1999 refueling outages. The inspections identified no indications but did identify the presence of debris, which was removed to the extent possible.

Conclusion

The BWR Vessel Internals Program has been demonstrated to be capable of managing cracking, loss of material and loss of fracture toughness of vessel internal components in a reactor coolant or steam environment. The program, with enhancement, will provide reasonable assurance that the aging effects will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.15 CLOSED TREATED WATER SYSTEMS PROGRAM

Program Description

The Closed Treated Water Systems Program is an existing mitigation and condition monitoring program that manages loss of material, cracking, and reduction of heat transfer due to fouling in components exposed to a closed treated water environment through monitoring and control of water chemistry, including the use of corrosion inhibitors, chemical testing, and visual inspections of internal surface condition. The *Closed Cooling Water Chemistry Guideline,* industry guidance, and vendor recommendations are used to delineate the program.

The in-scope Closed Treated Water Systems are:

- Emergency Closed Cooling Water
- Nuclear Closed Cooling
- Turbine Building Closed Cooling Water
- Turbine Building Chilled Water
- Control Complex Chilled Water
- Containment Vessel Chilled Water
- Building Heating

- Auxiliary Boiler
- Diesel Generator Jacket Water

NUREG-1801 Consistency

The Closed Treated Water Systems Program is an existing PNPP program that, with enhancements, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M21A, *Closed Treated Water Systems,* as revised by LR-ISG-2012-02.

Exceptions to NUREG-1801

None

Enhancements

No later than six months prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

The program will be enhanced to ensure aging effects are detected through periodic inspections. Visual inspections will be conducted whenever the system boundary is opened. Additionally, a representative sample of piping and components will be selected based on likelihood of corrosion or cracking and inspected at an interval not to exceed once in 10 years. **Program Elements Affected: Parameters Monitored/Inspected (Element 3); Detection of Aging Effects (Element 4); Monitoring and Trending (Element 5); Acceptance Criteria (Element 6)**

The program will be enhanced to change the chemical treatment of the Building Heating System from a hydrazine-based regime to one more suitable to the elevated system temperatures experienced at PNPP. **Program Elements Affected: Preventive Actions (Element 2)**

Operating Experience

The following operating experience examples provide objective evidence that the Closed Treated Water Systems Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The closed cooling and auxiliary systems strategic chemistry plan contains a comprehensive summary of operating experience at PNPP. System chemistry performance is documented, for example, the Nuclear Closed Cooling section describes ongoing out-leakage, effects of operation, and radioactive contamination that has occurred at PNPP, and chemical parameter trending is provided.

Plant operating history has shown, as documented in the plan, that PNPP has three areas (gaps) requiring long-term actions to resolve. Nuclear Closed Cooling system leakage and Aux Boiler/Steam tritium contamination require ongoing management attention. The question of Building Heating chemistry regime must be resolved to assure effective and efficient chemistry management.

An extensive review of Operating Experience is documented. The following summarizes operating experience related to closed-cycle cooling water systems.

PNPP has numerous examples of operating experience in which samples identified various discoloration indicating potential corrosion products. When this discoloration is found after a bleed and feed evolution this is usually due to agitation which lifts some of the normally closely adhering protective corrosion layer from the inside of the piping. Operating experience at PNPP with through wall leaks and weld cracking has also led to degraded performance. Together these indicate a need for the Closed Treated Water Systems Program at PNPP.

PNPP utilizes water testing and periodic inspections to identify the aging effects of corrosion or cracking of closed-cooling water systems. Recurring instances of corrosion are identified by 1) various minor leaks that do not result in degraded performance, 2) recurring chemistry samples out of spec (including presence of suspended corrosion products) requiring routine feed and bleed operations to correct, and 3) heat exchanger tube cracking and leaking.

<u>Leaks and Cracks</u>

Through-wall leaks, and weld cracks occur in water systems. Operating experience at PNPP indicates the occurrences of through wall leaks and cracks are normally isolated and don't recur in any particular sections of pipe or group of components, though they can affect system function. Examples of leaks and cracks include:

In December 2013 a Condition Report (CR) documented that a degraded weld was identified resulting in a leak in CC Chiller C that did not affect system operability. Per the associated work order, replaced a section of ½" pipe and an elbow were replaced.

<u>Chemistry out of Spec</u>

Chemical treatment is not a static function. Hydrazine degrades over time, a change in pH can be an indicator of in-leakage. The use of chemical additives is intended to aid in mitigating corrosion, controlling the pH of systems, and control of microbiological corrosion. Various routine evolutions, changing plant conditions, and operational necessity, such as swapping trains, can affect the chemistry of a closed-cooling water system. Periodic sampling identifies changing levels of chemical protection and results in the recurring need for "bleed and feed" operations to restore proper chemical content.

In November 2013 a CR documented that an area was identified for improvement in that closed loop cooling water is often out of specification due to equipment deficiencies or other reasons and that chemistry personnel had not advocated for prevention and correction of these conditions. The associated CR resulted in improved training on identifying and elevating recurring chemistry sampling problems for correction. The CR demonstrates the effectiveness of the PNPP self-assessment process for providing adequate measures to control chemistry to assure the current licensing basis intended functions of the components will be met through the period of extended operation.

Cracking and leaking

Tube cracking and/or leaks are common in heat exchangers and condensers. Non-destructive examination (NDE), such as eddy current testing, ultrasonic testing (UT), and liquid penetrant, are normally used to augment visual inspection whenever a heat exchanger or condenser system is opened for inspection. Plugging is often used to control leakage, most heat exchanger or condenser designs include identification of a certain number of tubes that may be plugged without affecting the design heat transfer performance.

In October 2013 a CR documented that a "milky" appearance in a water sample of the Emergency Closed Cooling System B loop. The B Control Complex Chiller was taken out of service and eddy current testing of condenser tubes was performed. One tube was found to have a crack-like indication, but no leak was identified. A tube leak could not be confirmed but the tube was plugged, and the chiller returned to service. There is no degradation in performance of the system. The CR demonstrates that PNPP is effective at identifying potential tube cracking.

The operating experience demonstrates that PNPP is effective at identifying, controlling, and repairing cracks and leaks to ensure minimal degradation of performance. Chemistry sampling has been effective at identifying opportunities to reduce the potential for corrosion and that self-assessment has led to improving chemistry personnel awareness and effectiveness. Cracking and leaking are effectively identified and actions to mitigate the leaks are addressed in a timely manner.

Conclusion

The Closed Treated Water Systems Program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.2.16 COMPRESSED AIR MONITORING PROGRAM

Program Description

The Compressed Air Monitoring Program is an existing condition monitoring program that manages loss of material in compressed air systems by periodically monitoring air samples for moisture and contaminants and by opportunistically inspecting internal surfaces within compressed air systems. The Compressed Air Monitoring program is based on the PNPP response to NRC Generic Letter 88-14, *Instrument Air Supply Problems Affecting Safety-Related Components,* and utilizes guidance and standards provided in INPO Significant Operating Report 88-01, *Instrument Air System Failures*. The UFSAR states the Compressed Air Monitoring meets the design requirements of ANSI Standard

MC-11-1 (ISA-S7.3) with the exception that maximum allowable particle size for air to safety-related equipment is 40 microns. Program activities include air quality checks at various locations to ensure that dew point, particulates, and hydrocarbons are maintained within the specified limits.

Air quality is monitored to determine if alert levels, or limits are being approached or exceeded. Particulates, dew points, and hydrocarbon content are monitored. The Compressed Air Monitoring Program will include opportunistic inspections, when components are opened for maintenance, repair, or surveillance to ensure that the existing environmental conditions are not causing material degradation that could result in a loss of component intended function during the period of extended operation.

NUREG-1801 Consistency

The Compressed Air Monitoring Program is an existing PNPP program that, with enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M24, *Compressed Air Monitoring*.

Exceptions to NUREG-1801

None

Enhancements

No later than six months prior to the period of extended operation, the following enhancements will be implemented in the identified program elements:

Perform opportunistic inspections of accessible internal surfaces of piping, receivers, compressors, dryers, aftercoolers, and filters within the compressed air systems. **Program Elements Affected: Parameters Monitored/Inspected (Element 3), Detection of Aging Effects (Element 4).**

A new monitoring and trending program will be developed to monitor and trend periodic dew point readings, results of each opportunistic visual inspection, and annual air samples. **Program Element Affected: Monitoring and Trending (Element 5).**

Operating Experience

The following operating experience review provides objective evidence that the Compressed Air Monitoring Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Compressed Air Monitoring program is based on the PNPP response to NRC Generic Letter 88-14 and utilizes guidance and standards provided in INPO SOER 88-01.

INPO SOER 88-01 Recommendation 4 provided guidance to ensure that instrument air quality is monitored and maintained effectively. An INPO SOER 88-01 Effectiveness

Review, performed in 2013, of dewpoints, particulates and hydrocarbon sampling/analysis results encompassing the period back to the previous 2011 SOER-01 Effectiveness Review was conducted. All instrument air samples results were within the desired specifications. It was concluded that actions recommended by Recommendation 4 of SOER 88-01 are in place and effective at PNPP.

A review of plant specific PNPP operating experience since 2013, through a search of plant Corrective Action Program documents identified 11 condition reports (CRs) potentially related to the XI.M24 Aging Management Plan. Five were found not relevant to XI.M24, five were found to be air leaks due to leaky connections or inadequate brazing. One identified an unsatisfactory dew point reading in safety related instrument air. An engineering evaluation concluded condensation was not occurring, actual dewpoint was acceptable. A new design for the air dryer was initiated and procedures revised.

No instances of unacceptable particulate, contaminants or dew point have been reported.

Conclusion

The Compressed Air Monitoring Program, with enhancement, will provide reasonable assurance that aging effects will be adequately managed such applicable components will continue to perform their intended functions consistent with the current licensing basis during the period of extended operation.

B.2.17 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRICAL COMPONENTS PROGRAM

Program Description

The Environmental Qualification (EQ) of Electrical Components Program is an existing program. The NRC has established nuclear station EQ requirements in 10 CFR 50.49 and 10 CFR Part 50, Appendix A, Criterion 4. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments (that is, those areas of the plant that could be subject to the harsh environmental effects of loss of coolant accident (LOCA), high energy line breaks (HELBs) or high radiation) are qualified to perform their safety function in harsh environments. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification.

The PNPP EQ Program is consistent with Regulatory Guide 1.89 Rev. 1 that describes a method acceptable to the NRC staff for complying with 10 CFR 50.49 with regard to qualification of electrical equipment important to safety to ensure that the equipment can perform its safety function during and after a design basis accident.

The PNPP program manages component thermal, radiation and cyclical aging, as applicable, through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished or replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered time-limited aging analyses (TLAAs) for License Renewal.

PNPP procedures provide a list of qualified components that are maintained in the PNPP Environmental Qualification Master List (EQML). For each component, the EQML references the Equipment Qualification Packages (EQPs), which include the qualified life, specification, electrical characteristics, and environmental conditions. PNPP procedures specify that the equipment data packages are maintained in the Auditable File Packages (AFPs). The equipment data packages in the AFPs are reanalyzed to extend the qualification of a component on a routine basis pursuant to 10 CFR 50.49(e) and utilizing the methods described below:

Analytical Methods

The analytical models used in the reanalysis of an aging evaluation are the same as those previously applied. The Arrhenius methodology is an acceptable model for a thermal aging evaluation. For license renewal radiation aging evaluation, 60-year normal radiation dose is established by extrapolating the 40-year normal dose by (40-year dose times 1.5) plus accident dose. 60-year cyclical aging is established in a similar manner. Other models may be justified on a case-by-case basis.

Data Collection and Reduction Methods

Reducing excess conservatism in the component service conditions (for example, temperature, radiation and cycles) used in the prior aging evaluation is the chief method for a reanalysis. Actual monitored service conditions such as temperature are generally lower than the design service conditions used in the prior aging evaluation and therefore can support extended thermal life of the equipment.

Underlying Assumptions

EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated, and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions.

Excess conservatism may be reduced by reevaluating the component service conditions and material properties used in prior aging evaluations for radiation and cyclical aging, to justify a value that would support extended life.

Acceptance Criteria and Corrective Actions

If qualification cannot be extended by reanalysis, the component is refurbished or replaced prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (that is, sufficient time is available to refurbish, replace, or re-qualify the component if the reanalysis is unsuccessful).

NUREG-1801 Consistency

The Environmental Qualification (EQ) of Electrical Components Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section X.E1 *Environmental Qualification (EQ) of Electrical Components*.

Exceptions to NUREG-1801

None

Enhancements:

None

Operating Experience

The following operating experience examples provide objective evidence that the Environmental Qualification (EQ) of Electrical Components Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The PNPP Environmental Qualification (EQ) of Electrical Components Program includes consideration of operating experience (OE) to modify qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended functions during accident conditions after experiencing the effects of in-service aging.

In May 2018, a snapshot self-assessment was performed. A vertical slice of documentation associated with three (3) EQ components: Limitorque motor, NAMCO limit switch, and Target Rock solenoids were reviewed. The review found there were no major deficiencies or challenges. Four follow-up Condition Reports to 1) document preventative maintenance frequency for Limitorque operators, 2) incorporate document changes and enhancements, 3) verify warehouse temperatures for Rosemount transmitters, and 4) revise valve lineup for magnesium rotors in Limitorque operators were written.

Condition reports from 2013 to present were reviewed with the following conditions identified:

- In March 2013, a condition report (CR) was written to document that a Baldor motor was approved for replacement of a Reliance motor for an MOV. The evaluation did not address the need revise the specification.

- In January 2014, a CR was written to document that 2,790 predictive maintenance (PM) items on components in a mild environment that would be managed as recommended by Regulatory Guide 1.89 instead of using the EQ program.

- In March 2014, a CR was written to document the motor Limitorque MOV 1E22-F001 exceeded the established EQ life. The corrective actions were to replace the affected motor. The cause was identified as gaps in work order steps and was evaluated as an isolated instance.

- In April 2018, a CR was written to document IN 86-02, which identified a failure of a Reliance motor during magnesium rotor Limitorque valve operator testing, resulted in a recommendation to change the post-LOCA valve lineups for 1E12-F0042A/B to remain open did not appear to have been implemented. Discussion with the MOV program owner confirmed the only remaining magnesium rotor valve operator is 1E12-F042B, and a procedure change was initiated to address the issue.

- In June 2018, a CR was written to document an issue identified during an NRC EQ DBA pre-inspection evaluation, in regard to whether warehouse temperature recorder records should be retained. A review of procedures determined there was no requirement. Peer discussions with other sites identified the records are retained. PNPP warehouse will begin retaining the temperature records.

- In March 2019, a CR was written to document that several calculations were identified for equipment in mild environments that still had active qualified life calculations. 35 calculations were revised or amended to indicate the components are no longer in the EQ program.

- In December 2019, a CR was written to document the motor starter for 1D19-P0400 exceeded its qualified life. It was found that, when last replaced, the Aux Contacts from the previous starter were installed in the new. A review of the calculation found that the aux contacts were the limiting EQ component within the starter. The motor starter was replaced.

- In March 2020, a CR was written to document that a Rosemount Part 21 notification on 1150 and 3150 transmitters to document that the qualification program did not account for self-heating. A review of existing EQ calculations noted that sufficient margin exists to allow continuing with the current replacement plans.

The review of operating experience including condition reports from 2013 to present indicates the EQ program at PNPP is effective at finding and correcting errors, PNPP is responsive to industry issues affecting the EQ program, and that no evidence of age-related degradation has been identified in EQ components.

Conclusion

The Environmental Qualification (EQ) Program provides reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.18 EXTERNAL SURFACES MONITORING OF MECHANICAL COMPONENTS PROGRAM

Program Description

The External Surfaces Monitoring of Mechanical Components Program is a new condition monitoring program that will manage aging effects of components fabricated from metallic and elastomeric materials through periodic visual inspection of external surfaces during system inspections and walkdowns for evidence of leakage, loss of material (including loss of material due to wear), and cracking, and change in material properties of elastomer structural commodities. The visual inspection of elastomers will detect change in material properties including cracking or crazing, swelling, discoloration and melting. Physical manipulation (of at least 10% of available surface area), such as touching, pressing, flexing, and bending, will be used to augment visual inspections to confirm the absence of hardening and loss of strength in elastomeric materials. The periodic inspections will include visual inspection of insulation jacketing to ensure the integrity of the jacketing is maintained.

The program is also credited with managing loss of material from internal surfaces of metallic components and with loss of material, cracking, and change in material properties from the internal surfaces of elastomers, for cases in which material and environment combinations are the same for internal and external surfaces such that external surface condition is representative of internal surface condition.

The inspections of external surfaces will be capable of detecting age-related degradation. Surfaces that are inaccessible or not readily visible during either normal plant operations or refueling outages will be inspected opportunistically and at such intervals that will ensure the components' intended function is maintained during the period of extended operation. Surfaces that are accessible will be inspected at an interval not to exceed one operating cycle. Inspections will be performed by personnel qualified through plant-specific programs. Deficiencies will be documented and evaluated under the Corrective Action Program.

Outdoor insulated components, and indoor insulated components exposed to condensation, will have portions of the insulation inspected or removed, during each 10-year interval of the period of extended operation, to determine whether the exterior surface of the component is degrading or has the potential to degrade.

The program will be implemented no later than six months prior to the period of extended operation. Visual inspection of external surfaces will be conducted once every operating cycle. A sample of insulated piping will be inspected every ten years during the period of extended operation. Inspections will commence during the period of extended operation.

NUREG-1801 Consistency

The External Surfaces Monitoring of Mechanical Components Program is a new program for PNPP that will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M36, *External Surfaces Monitoring of Mechanical Components* as revised by LR-ISG-2012-02.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the External Surfaces Monitoring of Mechanical Components Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

A review of plant-specific operating experience since 2013, through a search of plant Corrective Action Program documents found 138 corrective actions potentially related to XI.M36 or identifying degraded or potentially degraded insulation. A review of the operating experience found:

- In September 2016 a Condition Report (CR) documented damaged or missing insulation in the off gas vault refrigeration system.
- Numerous instances of component leaks throughout the plant that were obscured by overlying insulation (e.g., in July 2017 a CR documented a leak in the reactor core isolation cooling system from under the insulation). Such leaks could lead to insulation degradation.
- In February 2020 a CR documented that a visual inspection found evidence of corrosion of piping or components under insulation in the turbine building chilled water system.
- In February 2020 a CR documented corroded piping or components under insulation were found during repairs in the turbine building chilled water system.

All issues were corrected. The operating experience shows that routine walkdowns and inspections do identify degradation of outdoor components and indoor insulation and leaks under insulation that could identify cracks, seal degradation or failed components. Routine maintenance has shown that rust, flaking and other piping or component degradation does occur under insulation. No evidence of failed or leaking joints in jackets have been identified. Implementation of the External Surfaces Monitoring of Mechanical Components Program will assure system inspections and walkdowns inspect all outdoor accessible components and all indoor accessible insulation each operating cycle. Removal of a sampling of insulation to inspect piping and components will assure degradation from condensation occurring under the insulation will be detected.

Conclusion

The external surfaces monitoring of mechanical components program will provide reasonable assurance that aging effects will be managed such applicable components will continue to perform their intended functions consistent with the current licensing basis during the period of extended operation.

B.2.19 FATIGUE MONITORING PROGRAM

Program Description

The Fatigue Monitoring aging management program is an existing preventive program that manages fatigue damage of reactor coolant pressure boundary and other components subject to the reactor coolant, treated water, steam, and air-indoor uncontrolled environments. The program ensures that the cumulative fatigue usage remains within allowable ASME Code limits by tracking the critical thermal and pressure transients for selected systems and components and evaluating the resulting incremental fatigue. The program includes monitoring the transients consistent with Technical Specification 5.5.5, Component Cyclic or Transient Limits, UFSAR Tables 3.9-1 and 3.9-2, and UFSAR Figures 3.9-24 through 3.9-30. To accomplish the fatigue evaluation, the program considers the number of transients, the severity of monitored transients, and the impact of the reactor coolant environment.

The program provides for the collection and trending of data associated with the reactor pressure vessel, the reactor coolant pressure boundary components, and the containment vessel. The program calculates cumulative usage factors (CUFs) and requires corrective actions if design limits are approached. This is accomplished by the use of cycle-based fatigue monitoring where fatigue is computed from counted transients and parameters to ensure that the CUFs for the limiting components do not exceed the design limit of 1.0 (or 0.1 for high energy line break exclusion criteria), including environmental effects where applicable.

The effect of the reactor coolant environment on component fatigue life has been determined by performing environmental fatigue analyses for a sample of critical locations selected using NUREG/CR-6260 guidance. Additional environmental fatigue analyses were performed for limiting locations in the reactor coolant pressure boundary. Environmentally adjusted fatigue usage factors (CUF_{en}) were computed in accordance with the guidance specified in NUREG/CR-6909 for the affected materials. Water chemistry parameters are monitored by the PNPP Water Chemistry Program.

NUREG-1801 Consistency

The Fatigue Monitoring Program is an existing PNPP program that, with enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section X.M1 Fatigue Monitoring.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented no later than six months prior to the period of extended operation:

The station implementing procedures will be updated to clarify the scope of the Fatigue Monitoring Program. **Program Elements Affected: Scope of Program (Element 1)**

The program fatigue monitoring software will be augmented to include environmental correction factors (F_{en} multipliers) for the locations where monitoring the environmental fatigue has been determined to be applicable to ensure the cumulative fatigue, including environmental fatigue, does not exceed the ASME Code, Section III limits. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored/Inspected (Element 3), Monitoring and Trending (Element 5).**

Operating Experience

The following operating experience examples provide objective evidence that the Fatigue Monitoring Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

NUREG-0619 discusses several BWR plants that have experienced cracking in the feedwater nozzles and connecting feedwater spargers and provides several recommendations for inspections and design improvements. Based on this industry operating experience, augmented UT inservice inspections were performed on all six of the BWR feedwater nozzles, which are discussed in the BWR Feedwater Nozzle Program.

In March 2012, the Reactor Pressure Vessel Cycle Monitoring program indicated that for the controlling transient, the shutdown transient, there was one remaining available transient. It was determined that were no adverse consequences resulting from exceeding the number of available design transient shutdown cycles because the design cycles were not design limits for the component. Corrective actions included projecting cyclic transients out to 40 and 60 years based on past operating history, adding additional shutdown and loss of feedwater events to the design cycle diagrams and implementation of a fatigue monitoring program that interfaces with the plant computer instrumentation. Implementation of the fatigue monitoring program was already on going at the time this transient limitation was identified. Once the fatigue monitoring program was in place, the evaluation of the limiting reactor component was re-analyzed and shown to have improved margin.

In June 2013, a program effectiveness review performed by PNPP identified that the Fatigue Monitoring Program lacked a formal process for analyzing and documenting the fatigue data in a timely manner. The cause of the issue was determined to be inadequate resources committed to completing these tasks. Responsibility for the program was re-assigned to an engineering group with adequate resources and management oversight to ensure that fatigue would be analyzed and documented in a timely manner. Additionally, the backlog of fatigue data was evaluated with vendor assistance and the fatigue data evaluation and documentation was brought up to date.

In April 2015, continuing issues with evaluating and documenting fatigue management issues were identified in a PNPP program effectiveness review. The actions taken in response to this review, included updating and validating the fatigue monitoring data through the end of 2013-2015 operating cycle; documenting the updating fatigue data and verifying the accuracy of the documented fatigue data; and modifying the fatigue monitoring software results to accurately depict the thermal cycles from the verified plant data. Subsequent effectiveness of the fatigue monitoring program indicated that the issues with timely evaluation and documentation were resolved.

In September 2022, it was identified that 24 RCIC injections from a transient in 2001 had not been included in the fatigue analyses since that timeframe. The initial evaluation determined that RCIC piping node 45-J-1-TTJA would exceed its allowable cumulative fatigue usage value (greater than 1.0). A subsequent and more refined analysis demonstrates that this RCIC node has significant fatigue usage margin.

Conclusion

The Fatigue Monitoring Program, with enhancement, will assure the fatigue design basis is maintained such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.20 FIRE PROTECTION PROGRAM

PROGRAM DESCRIPTION

The Fire Protection Program is an existing condition monitoring and performance monitoring program that manages the aging effects for components in the scope of license renewal that have a fire barrier function. The program requires periodic visual inspection of fire barrier penetration seals; fire barrier walls, ceilings, and floors; and periodic visual inspection and functional tests of fire-rated doors to ensure that their operability is maintained. The program also includes periodic inspection and testing of the carbon dioxide (CO_2) fire suppression systems. There are no in-scope halon fire suppression systems.

The Fire Protection AMP manages the following aging effects of structural commodities in air with a fire barrier function:

- Loss of material including 3M Interam, concrete, aluminum, elastomers, Pyrocrete and steel.
- Cracking of concrete, aluminum, elastomer, Pyrocrete and stainless steel
- Cracking / delamination of 3M Interam

- Change in material properties of concrete (loss of bond and reduction of strength), elastomer (such as cracking or crazing, swelling, discoloration and melting), various types fireproofing, seals & sealants, fire wrap materials 3M Interam, Unimpregnated and impregnated (with elastomer) fiber glass fabric cracking, delaminating and visible deterioration)
- Loss of sealing of elastomers

The Fire Protection AMP includes visual inspections of 100 percent of each type of penetration fire seal every 15 years in accordance with the plant's NRC-approved fire protection program. Visual inspections of the fire barrier walls, ceilings, and floors in structures within the scope of LR are performed at a frequency in accordance with the fire protection program consistent with the current licensing basis (CLB). The frequency of visual inspections of the fire door surfaces and functional testing of fire door closing mechanisms and latches is in accordance with the CLB.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The Fire Protection Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M26, *Fire Protection*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Fire Protection Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Fire Protection Program requires periodic visual inspection of fire barrier penetration seals; fire barrier walls, ceilings, and floors; and periodic visual inspection and functional tests of fire-rated doors to ensure that their operability is maintained. The program also includes periodic inspection and testing of the carbon dioxide (CO_2) fire suppression systems.

The following summarizes the results of the PNPP operating experience review for license renewal for the fire protection program .

In December 2015, a Condition Report (CR) was written to document an approximately 2 foot square hole was identified in the drywall barrier between Unit 2 Division 1 and Unit

2 Division 2 DC switchgear rooms. UFSAR was not updated correctly when Unit 2 project was suspended. The barriers on the Unit 2 side related to the DC switchgear appear to have never been finished, and the hole identified is a result. The CR investigation revealed that the ability to achieve and maintain safe shutdown is assured and all design and license requirements are met. The hole was reworked to its as-designed configuration as an F-3 barrier. Lastly, the A caution statement in system operating instructions for both Division 1 and Division 2 was clarified such that it specifically states that simultaneous use of both Division 1 and Division 2 Unit 2 Class 1E DC systems to support Unit 1 operation is outside the bounds of the site safe shutdown capability analysis. It was determined that no UFSAR change was warranted.

Summary Review of CRs from 2013 through January 2023.

More than 180 CRs were identified as being related to the aging management program XI.M26, *Fire Protection Program*. A significant majority (~91%) were related to deficiencies with fire doors including function. The defects primarily involved degraded operation with some failure to remain shut. Less than 10% involved degraded fire barriers. All of the identified issues were satisfactorily resolved through investigation and rework, as applicable.

<u>Design Basis Assessment Reports (DBAR) 2013-2022</u>

The DBARs are periodic assessment reports of the implementing programs/processes to maintain the design and licensing basis for the facility. A section of the DBAR is focused on compliance with applicable fire protection regulations and with analyses to demonstrate shutdown capability after a fire in any plant area.

A review of DBAR sections related to fire protection over a 10-year period from the last half of 2012 through the first half of 2022 revealed that these assessments rated the performance of the program no lower than acceptable about 60% of the time and excellent about 40% of the time. The excellent category being achieved between starting in the first half of 2017.

Conclusion

The Fire Protection Program has been effective at managing aging effects. The continued implementation of the program provides reasonable assurance that the effects of aging will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.2.21 FIRE WATER SYSTEM PROGRAM

Program Description

The Fire Water System Program (a sub-program of the overall Fire Protection Program) is an existing condition monitoring program that applies to the fire water supply and water-based suppression systems, which include sprinklers, nozzles, fittings, valve bodies, fire pump casings and heat exchanger, hydrants, hose stations, standpipes, a pressure maintenance tank, various retarding chambers (tank), Foam Liquid Storage Tank (component types Tank), and aboveground, buried and underground piping and components. The PNPP Firewater System does not have a fire water storage tank. The program conducts tests and inspections in accordance with applicable National Fire Protection Association (NFPA) codes and standards. These codes and standards will have enhanced flow testing and visual inspections performed in accordance with the 2011 Edition of NRPA 25 as described below.

The Fire Water System Program manages:

- loss of material due to general, crevice, pitting corrosion, MIC, macrofouling leading to corrosion, and erosion;
- flow blockage due to fouling;
- reduction in heat transfer (for the diesel driven fire pump engine); and,
- change in mechanical properties due to blistering of ASTM D-2996 fiberglass reinforced epoxy piping.

This program manages the aging effects using flow testing and visual inspections, and for heat exchanger reduction in heat transfer, through periodic visual inspections for fouling and periodic cleaning, as needed. In addition to NFPA codes and standards, those portions of the system that are (a) normally dry but periodically subject to flow (e.g., dry-pipe or preaction sprinkler systems) and (b) cannot be drained or allow water to collect, are subjected to augmented testing or inspections. The water-based fire protection system is normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

Testing or replacement of sprinkler heads that have been in service for 50 years will be performed in accordance with the 2011 Edition of NFPA 25. Portions of the water-based fire water system that (a) are normally dry, but periodically subject to flow (e.g., dry-pipe or downstream of the deluge valve in a deluge system); and (b) cannot be drained or allow water to collect are subject to augmented examination beyond that specified in NFPA 25. The augmented examinations for the portion of normally dry piping that are periodically wetted or experience recurring internal corrosion include (a) periodic full flow tests at the design pressure and flow rate, or internal inspections; and (b) volumetric wall thickness evaluations. In addition, if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material will be removed and its source will be determined and corrected. For the buried piping, visual inspections of the piping interior surfaces will be performed whenever the piping internal surface is made accessible due to maintenance and repair activities.

Consistent with NUREG-1801, other aging management programs are relied upon to manage aging effects in the Fire water system and are not considered exceptions.

Where above-grade and underground or buried piping environments and material are similar, the above-grade can be extrapolated to evaluate the condition of the underground or buried piping. Otherwise, the internal condition of underground or buried piping will be inspected whenever the piping internal surface is made accessible due to maintenance activities. The external surface of piping, piping components, and piping elements in soil is managed by the XI.M41, *Buried and Underground Piping and Tanks*.

Bolting aging effects are managed by the Bolting Integrity Program (AMP XI.M18).

External surface corrosion of Fire Water System metallic piping in air is managed by the XI.M36, *External Surfaces Monitoring of Mechanical Components*, and piping elements in soil is managed by the XI.M41, *Buried and Underground Piping and Tanks*.

The XI.M33, *Selective Leaching* program manages selective leaching in gray cast iron piping and piping components subjected to raw water and soil.

NUREG-1801 Consistency

The Fire Water System Program is an existing PNPP program that, with enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M27, *Fire Water System* as revised by LR-ISG-2012-02 and LR-ISG-2013-01.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented in the identified program elements no later than six months prior to the period of extended operation.

The program will be enhanced to include inspections and testing consistent with Appendix L, Table 4a, *Fire Water System Inspection and Testing Recommendations*, of License Renewal Interim Staff Guidance LR-ISG-2012-02**. Program Element Affected: Detection of Aging Effects (Element 4)**

As an enhancement to detect aging effects of internal surfaces of buried piping, a portion of the aboveground inspection locations will be selected where above-grade and underground or buried piping environments and material are similar, the above-grade can be extrapolated to evaluate the condition of the underground or buried piping**. Program Elements Affected: Parameters Monitored (Element 3) and Detection of Aging Effects (Element 4)**

The program will be enhanced to require that when visual inspections are used to detect loss of material, including loss of material in the piping within the scope of license renewal due to recurring internal corrosion, the inspection technique is capable of detecting surface irregularities that could indicate wall loss to below nominal pipe wall thickness due to corrosion and corrosion product deposition. Where such irregularities are detected, follow-up volumetric wall thickness examinations will be performed**. Program Elements Affected: Parameters Monitored (Element 3) and Detection of Aging Effects (Element 4)**

The program will be enhanced to include augmented testing and inspections beyond those of Table 4a for portions of water-based fire protection system components within the scope of license renewal that are (a) normally dry but periodically subjected to flow (e.g., dry-pipe or preaction sprinkler system components) and (b) cannot be drained or allow water to collect: **Program Elements Affected: Parameters Monitored (Element 3) and Detection of Aging Effects (Element 4)**

- In each 5-year interval, beginning 5 years prior to the period of extended operation, a flow test or flush sufficient to detect potential flow blockage will be conducted, or a visual inspection of 100 percent of the internal surface of piping segments will be conducted.
- In each 5-year interval of the period of extended operation, 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect will be subject to volumetric wall thickness inspections. Measurement points will be obtained to the extent that each potential degraded condition can be identified (e.g., general corrosion, MIC). The 20 percent of piping inspected in each 5-year interval will be in different locations than previously inspected piping.
- If the results of a 100-percent internal visual inspection are acceptable, and the segment is not subsequently wetted, no further augmented tests or inspections are necessary.

The program will be enhanced to perform representative sprinkler head sampling (laboratory field service testing) or replacement of sprinkler heads within the scope of license renewal prior to 50 years in-service (installed), and at 10-year intervals thereafter, in accordance with the 2011 Edition of NFPA 25, or until there are no untested sprinkler heads that will see 50 years of service through the end of the period of extended operation. **Program Element Affected: Detection of Aging Effects (Element 4)**

The program will be enhanced to require at a minimum of once per 10 year interval visual inspection of the engine heat exchanger for the diesel driven fire water pump to monitor for conditions that could cause a reduction in heat transfer. **Program Element Affected: Detection of Aging Effects (Element 4)**

The program will be enhanced to provide that if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material will be removed and its source will be determined and corrected. **Program Elements Affected: Acceptance Criteria (Element 6)**

Operating Experience

The following operating experience examples provide objective evidence that the Fire Water System Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Fire Water System program is a subsystem in the XI.M26, *Fire Protection Program*. Operating experience related to programmatic issues in the Fire Water System Program are addressed in the XI.M26, *Fire Protection Program*. Two instances of procedure weaknesses were also Identified and addressed during audits from outside agencies.

Between 2013 and January 31, 2023, there were thirty-five (35) condition reports (CR) identified in the site OE that are considered age related. Eighty percent (28 CRs) were associated with leaks in piping. Of the 28 CRs, 12 CRs are characterized as above ground pin hole leaks. Seven 7 CRs are from buried pipe and 9 CRs of the remaining above ground leaks ranged from 10 dpm to a separated 6" pipe. Six (6) of the 35 age related CRs were associated with flow blockage and one of these 6 CRs involved a recent investigation of multiple occurrences. Finally, one CR involved a severely eroded jockey pump casing.

The PNPP OE reviewed covers a longer time span than the 10 years cited above. The observed OE events have been consistent through the monitored time period. The Fire Water System Program including the corrective action program has shown to be consistent at identifying, repairing and/or replacing degrading equipment. More importantly, these examples demonstrate that this condition monitoring program will continue to be effective at maintaining the intended functions through the period of extended operation.

LR-ISG-2012-02 has been issued which addresses instances of recurring internal corrosion. A review of the PNPP operating experience determined that recurring internal corrosion has been experienced in the Fire Protection System with a frequency that is consistent with the thresholds discussed in LR-ISG-2012-02. The steel Fire Protection System piping is subjected to localized pitting; however, the pitting is not indicative of a gross degradation of the system. The localized pitting is due to the use of untreated lake water.

There have been numerous instances where one or more transformer deluge spray nozzles have had either partial or full obstructions due to scaling deposits. Transformer deluge systems are not required to protect safe shutdown components. Blockage affected the designed spray pattern, but the restricted nozzles were still capable of performing their fire suppression ability in a transformer fire. The blocked nozzles were cleaned. Regular water flow tests are performed to flush out the rust and scaling in the system.

Operating experience shows that issues are address quickly via the corrective action program and work scheduled based upon significance.

External Industry OE were reviewed for applicability to the XI.M27 program. No new aging effects were identified. NUREG-2191 (GALL-SLR) has identified ductile iron as being susceptible to selective leaching and be managed under the Selective Leaching AMP XI.M33. Ductile iron components in the Fire Water system are included with components labeled as gray cast iron in the aging management review tables and are assigned the same aging effects. Additionally, the internal OE is consistent with the industry OE identified as applicable by the SME. The NUREG-1801 program is based upon industry OE and the applicable industry standards meant to address these concerns. Since the PNPP AMP is consistent with the NUREG-1801 program as modified by the applicable ISG and Subsequent LR program information, it is reasonable to conclude the PNPP condition monitoring and performance monitoring program is capable of management the identified aging effects.

Conclusion

The Fire Water System Program has been effective at managing aging effects. The continued implementation of the program, with enhancements, provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.2.22 FLOW-ACCELERATED CORROSION PROGRAM DESCRIPTION

PROGRAM DESCRIPTION

The Flow-Accelerated Corrosion (FAC) aging management program is an existing condition monitoring program based on the Electric Power Research Institute (EPRI) guidelines in NSAC-202L *Recommendations for an Effective Flow-Accelerated Corrosion Program* to provide reasonable assurance that all the aging effects caused by flow accelerated corrosion (FAC) and wall thinning due to various erosion mechanisms are properly managed. The program consists of a) performing an analysis to determine systems susceptible to FAC, b) conducting appropriate analyses to predict wall thinning, c) performing wall thickness measurements based on wall thinning predictions and operating experience, and d) evaluating measurement results to determine the remaining service life and the need for replacement or repair of components.

The PNPP FAC program complies with the EPRI NSAC-202L guidelines endorsed by the NRC as cited in NUREG-2191 and on internal and external operating experience.

The FAC program manages FAC and wall thinning caused by various erosion mechanisms other than FAC, in elements subject to wall thinning, including valve bodies, piping, piping components and piping elements from. mechanisms such as cavitation, flashing, droplet impingement, and solid particle impingement, when periodic monitoring is used in lieu of eliminating the cause of these various erosion mechanisms.

The program, with enhancement, will be continued for the period of extended operation.

NUREG-1801 Consistency

The Flow Accelerated Corrosion Program is an existing PNPP program that, after enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M17 *Flow-Accelerated Corrosion* and revised by LR-ISG-2012-01.

Exceptions to NUREG-1801

None

Enhancements:

Site procedures will be enhanced no later than six months prior to the period of extended operation to include pump casings and valve bodies that retain pressure in systems susceptible to FAC. Opportunistic inspections of internal surfaces are conducted during routine maintenance activities to identify degradation.

Operating Experience

The following operating experience examples provide objective evidence that the Flow-Accelerated Corrosion (FAC) Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The FAC Program is a mature, well-structured program at PNPP. The program implements the recommended actions of NRC Generic Letter (GL) 89-08, and is effective in managing FAC in steel piping and components containing high-energy fluids.

The program has been the subject of internal assessments (with industry participation), and improvements, as well as of fleet-wide assessments (including comparison to corresponding industry peer programs). It includes the evaluation of industry operating experience for impact to the program.

Results of inspections and evaluations are compiled into an outage FAC report for each operating cycle. For Refuel Outage (RFO) 18 (1R18), there were approximately 62 locations inspected. 21 examinations based on CHECWORKS analytical model information, 17 locations examined based on new component installation, 17 based on operating experience, and 7 based on FAC program trending. In addition to the Ultrasonic Thickness Testing (UTT) inspections being completed, two piping replacements were completed to remove temporary modifications. No entry was made into the condenser based on scope reduction due to COVID-19.

Findings of examinations under the FAC program in RFO16 were summarized in a May 2017 Condition Report (CR). The CR identifies components examined and found to exhibit wall thinning. Eleven components were identified. A recommendation for further monitoring and identification of an outage for replacement was identified.

In RFO17 the results of ultrasonic (UT) inspections on Reactor Water Cleanup (RWCU) system piping and components indicated three components, 1G33-024/4D1-3 E003, 1G33-024/4D1-3 E004, and 1G33-024/4D1-3 E010, with less than allowable wall thickness, EPRI CHECWORKS evaluated less than 2 cycles remaining life. A work order documents replacement of the pipe segment that included all affected components.

In April 2021, a CR documented degradation in two elbows as required by the FAC program and to determine options for corrective actions. The cause of the degradation was found to be unknown but not typical of flow-accelerated corrosion, and projected to be acceptable to RFO20. It was recommended a metallurgical failure analysis of the elbows be conducted and that inspection scope in the area be expanded in RFO18 to determine the extent of the damage.

The above site-specific operating experience from the most recent refueling outages at PNPP provides representative examples of the related operating experience documented over operating cycles since the first implementation of the FAC program in the early 1990’s. Based on site-specific operating experience and industry operating experience, the FAC program has been shown to effectively identify wall thinning, predict potential failures, and respond to failures outside of the samples chosen for inspection.

A review of NUREG-2191 identified that EPRI Guideline NSAC-202L, Revisions 2, 3, or 4 are acceptable.

Conclusion

The Flow Accelerated Corrosion Program has been effective at managing aging effects. The program, with enhancement, provides reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.23 FUEL OIL CHEMISTRY PROGRAM

Program Description

The Fuel Oil Chemistry Program is an existing condition monitoring, prevention and mitigation program that manages cracking, loss of material due to corrosion, and fouling that results in corrosion in piping and components exposed to an environment of diesel fuel oil. Prevention and mitigation are accomplished by verifying the quality of fuel oil and controlling fuel oil contamination as well as periodic draining, cleaning, and inspection of fuel oil tanks.

Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the plant’s technical specifications and ASTM standards. Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by periodic draining or cleaning of tanks and by verifying the quality of new oil before its introduction into the storage tanks, including addition of a biocide.

The fuel oil tanks are visually inspected internally for signs of moisture, contaminants and corrosion. Internal tank inspections will be performed at least once during the ten-year period prior to the period of extended operation, and at least once every ten years during the period of extended operation. Volumetric inspection will be performed if visual inspection is not possible, or evidence of degradation is observed during visual inspection. Inspection frequencies are in accordance with the plant's technical specifications and applicable industry standards and guidance documents.

The effectiveness of the Fuel Oil Chemistry Program is verified by the One-Time Inspection Program.

NUREG-1801 Consistency

The Fuel Oil Chemistry Program is an existing PNPP program that, with enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M30, *Fuel Oil Chemistry*.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented in the identified program elements no later than six months prior to the period of extended operation.

Additional information will be placed in Periodic Maintenance tasks. Periodic Maintenance tasks for the Diesel Fire Pump Fuel Oil Storage Tank will be revised to reflect that the minimum required schedule for inspections to satisfy Aging Management Program requirements are consistent with a 10-year interval. **Program Elements Affected: Preventive Actions (Element 2) and Detection of Aging Effects (Element 4)**

Volumetric inspection will be performed if visual inspection is not possible, or evidence of degradation is observed during visual inspection. **Program Element Affected: Detection of Aging Effects (Element 4)**

Operating Experience

The following operating experience examples provide objective evidence that the Fuel Oil Chemistry Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

In October 2015, analysis results for an annual Division 1 Fuel Oil Storage Tank exceeded the administrative limit for Water and Sediment. Backup Samples were analyzed, and the results were below the administrative limit. Program driven actions were performed by plant staff to ensure fuel quality in accordance with procedural requirements.

In October 2015, the analysis result for the Fire Diesel Fuel Oil Storage Tank exceeded the water and sediment limit. The sample was obtained after the tank had been drained, cleaned, inspected, rinsed with fuel oil and refilled. The tank contents were recirculated through a five-micron filtration apparatus. After filtration, water and sediment analysis results were within the specification. Additional filtration through a two-micron filter was performed to ensure results remained within specification. Approximately one week later, duplicate samples from the tank were analyzed for water and sediment with results below detectable limits.

In January 2016 the water and sediment analysis for the Fire Diesel Fuel Oil Storage Tank exceeded the administrative limit. Follow-up duplicate sample results were below the administrative limit. Small amounts of water and sediment were observed during the sample purge. The sample purge removed the trace water and sediment, and the backup sample results were satisfactory.

In July 2018, a Chemistry Technician observed water and sediment in the initial purge of a Fire Diesel Fuel Oil Storage Tank sample. The condition was documented in a condition report; the subsequent sample did not contain visible water and sediment, and analysis results were satisfactory. The associated condition report demonstrates an awareness of potential adverse conditions based upon operating experience with the Fire Diesel Fuel Oil Storage Tank.

In January 2019, vendor laboratory analysis results were received for the Division 1 Fuel Oil Storage Tanks indicating administrative limits were exceeded for Cetane Number and Lubricity. A duplicate sample as well as an additional sample taken later were sent to the laboratory. Analysis results for the resubmitted samples were below the administrative limits for both parameters.

In May 2021, a fuel oil delivery for the Division 3 Fuel Oil Storage tank was refused because the receipt analysis for flash point did not meet the required specification. The associated condition report documents how the receipt inspection is effective in preventing the introduction of unacceptable fuel oil into the storage tank.

These operating experience examples provide objective evidence that deficiencies found during fuel oil tank inspection and sampling activities are documented in the corrective action program, and corrective actions are implemented to maintain component intended functions.

External Industry OE were reviewed for applicability to the XI.M30 program. No new aging effects were identified.

Conclusion

The Fuel Oil Chemistry Program has been effective at managing aging effects. The program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.24 FUSE HOLDERS PROGRAM

Program Description

The Fuse Holders Program is a new Condition Monitoring Program. The program provides reasonable assurance that the intended functions of the metallic clamps of fuse holders located outside of active devices are maintained consistent with the current licensing basis through the period of extended operation. Fuse holders located inside an active device are not within the scope of this program. Fuse holders subject to increased resistance of connection due to chemical contamination, corrosion, and oxidation or fatigue caused by ohmic heating, thermal cycling or electrical transients will be tested, by a proven test methodology, at least once every 10 years to provide an indication of the condition of the metallic clamps of the fuse holders.

The first tests for license renewal will be completed no later than six months prior to the period of extended operation.

NUREG-1801 Consistency

The Fuse Holders Program is a new PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.E5, *Fuse Holders*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

Industry operating experience has shown that loosening of fuse holders and corrosion of fuse clips are aging mechanisms that, if left unmanaged, could lead to a loss of electrical continuity.

A review of plant-specific operating experience has found no evidence of thermal anomalies in annual tests of fuse holders outside active devices from 2003 to 2021.

Conclusion

The implementation of the Fuse Holders Program with enhancement, provides reasonable assurance that the aging effects will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.25 INSPECTION OF INTERNAL SURFACES IN MISCELLANEOUS PIPING AND DUCTING COMPONENTS PROGRAM

Program Description

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new condition monitoring program that will include visual inspections of the internal surface of in-scope components that are not included in other aging management programs for cracking, loss of material, and reduction in heat transfer. The program will include inspections of the internal surfaces of piping, piping components and piping elements, ducting, heat exchanger components, and other components that are exposed to environments of uncontrolled indoor air; outdoor air; condensation, moist air, diesel exhaust, fuel oil, lubricating oil, and any water environment other than open-cycle cooling water, closed treated water, and fire water. Aging effects identified for elastomers, both internal and external surfaces, will be managed by the External Surfaces Monitoring Program. License renewal in-scope polymers have no identified aging effects requiring management.

The internal inspections will be performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. At a minimum, in each 10-year period during the period of extended operation a representative sample of 20 percent of the population (defined as components having the same combination of material, environment, and aging effect) or a maximum of 25 components per population will be inspected. Where practical, the inspections will focus on the bounding or lead components most susceptible to aging because of time in service, and severity of operating conditions. Opportunistic inspections will continue in each period despite meeting the sampling limit. The program will include visual inspections to ensure that existing environmental conditions are not causing material degradation that could result in a loss of the component's intended function.

Visual inspections will include all accessible internal surfaces. Unless otherwise required (e.g., by the ASME code), inspections will be carried out using plant-specific procedures by inspectors qualified through plant-specific programs. The inspections will be capable of detecting the aging effect(s) under consideration. Indications of relevant conditions of degradation detected during the inspections will be evaluated and compared to acceptance criteria.

Conditions that do not meet the acceptance criteria will be entered into the Corrective Action Program for evaluation. Any indications of relevant degradation will be evaluated using design standards, procedural requirements, current licensing basis, and industry codes or standards.

This AMP does not manage components in which recurring internal corrosion is a known issue. Operating experience has not identified instances of recurring internal corrosion for components within the scope of this program.

Inspections begin during the period of extended operation.

The program will be implemented no later than six months prior to the period of extended operation.

NUREG-1801 Consistency

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program for PNPP that will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M38 *Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components*, as revised by LR-ISG-2012-02.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is a new program based on the program description in NUREG-1801 Section XI.M38, *Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components*, which in turn is based on industry OE that demonstrates that the activities applied in this program are effective for managing the relevant aging effects.

As discussed in element 10 to NUREG-1801, Section XI.M38, inspections of internal surfaces during the performance of periodic surveillance and maintenance activities have been in effect at many utilities in support of plant component reliability programs. These activities have proven effective in maintaining the material condition of plant systems, structures, and components. The elements that comprise these inspections (e.g., the scope of the inspections and inspection techniques) are consistent with industry practice and staff expectations.

A review of PNPP operating experience conducted in conjunction with developing the license renewal application, did not identify recurring internal corrosion of in-scope components (i.e., components that credit the XI.M38 AMP for aging management). Therefore, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program does not require augmented inspections for recurring internal corrosion.

The PNPP operating experience review identified a number of instances with blockage of drains in floors and ventilation plenums, however, these were not attributed to loss of material of the leakage boundary. Internal OE identified instances of leakage from a sink drain line likely caused by corrosive chemicals being drained in the sink. The damaged hard pipe was replaced with new plastic pipe. Internal OE also identified leaks in non-safety related ventilation plenum heating and cooling coils, attributed to freezing, that were repaired. Other OE identified instances of internal corrosion associated with out of scope components that would not be managed under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. None of the internal operating experience reviewed were identified as consequential to plant operation.

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program. Industry operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is executed and will be factored into the program via the confirmation and corrective action elements of the PNPP 10 CFR 50 Appendix B quality assurance program.

As such, operating experience assures that implementation of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Conclusion

Implementation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will provide reasonable assurance that the aging effects will be managed so that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.26 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS PROGRAM

Program Description

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program is an existing condition monitoring program that manages loss of material and loss of preload for bolting for cranes, trolley and bridge structural components, fuel handling equipment and applicable rails within the scope of license renewal. Visual inspections will manage loss of material due to corrosion of structural members and bolting, loss of material due to wear of rails, and loss of preload for bolted connections.

The cranes, monorails and hoists within the scope of license renewal are those defined by NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants*, and light load equipment handling systems related to refueling operations.

Crane preventive maintenance inspections are performed in accordance with the requirements of American National Standards Institute (ANSI) B30.2-1976 for overhead and gantry cranes and the vendor service manuals. For those cases where requirements differ, the more stringent requirement is applied. For cranes that are infrequently in service, such as the reactor building crane (a.k.a., polar crane), a verification is required that preventive maintenance inspections have been completed no more than one year (365 days) prior to each use. Also, the cranes comply with the maintenance rule requirements provided in 10 CFR 50.65.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M23, *Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

A review of PNPP operating experience has not identified corrosion-related degradation that threatened the ability of a crane to perform its intended function. Likewise, because the PNPP cranes have not been operated beyond their design number of cycles, there have been no fatigue-related structural failures. LRA Section 4.7 provides the evaluation of crane load cycles.

In June 2010, PNPP experienced loose bolts/nuts on the bearing cap of a bridge truck for the fuel handling building crane. These bolts had lock washers installed but were not compressed. Corrective action included tightening the bolts until proper compression of the lock washers was achieved. In addition, a corrective action was initiated and completed that added bolting inspection requirements to the crane preventive maintenance procedures. With implementation of the new inspection requirements, bolted connections are monitored for loose bolts, missing or loose nuts, and if loose or replaced, are torqued to a specified value.

Since 2013 various condition reports were written to document deficiencies associated with heavy loads/crane operations. Additionally, the plant structure monitoring procedure includes periodic inspections of plant buildings which identify any such deficiencies and appropriate corrective actions have been taken accordingly.

Regulatory Issues Summary (RIS) 2005-025, Clarification of NRC Guidelines for Control of Heavy Loads was issued in October 2005, and Supplement 1 to this RIS was issued in May 2007. These documents were issued to clarify guidance related to the control of heavy loads, as a result of recommendations developed through Generic Issue 186, "Potential Risk and Consequences of Heavy Load Drops in Nuclear Power Plants," and findings developed through the NRC inspection program. This RIS clarifies and reemphasizes existing regulatory guidelines that enhance human performance or compensate for human performance errors. Determination was made that the RIS and its Supplement did not identify any new age-related information.

Conclusion

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program has been demonstrated to be capable of managing loss of material and loss of preload for bolting for cranes, trolley and bridge structural components, fuel handling equipment and applicable rails within the scope of license renewal. The continued implementation of this program provides reasonable assurance that the effects of aging will be managed such that components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.27 INTERNAL COATINGS/LININGS FOR IN-SCOPE PIPING, PIPING COMPONENTS, HEAT EXCHANGERS, AND TANKS PROGRAM

Program Description

The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks Program is a new condition monitoring program that will perform periodic visual inspections of internal coatings of in-scope components. The program will manage the loss of coating integrity in heat exchangers, piping, piping components, piping elements, and tanks. Even though this is a new program, some aspects of this program already existed at PNPP, such as diesel generator fuel oil storage tank periodic draining, sludge and sediment removal, cleaning, and internal coating inspection.

Inspections will be performed for signs of coating failures and precursors to coating failures including peeling, delamination, blistering, cracking, flaking, chipping, rusting, and mechanical damage. When acceptance criteria are not met, physical testing will be performed where physically possible (i.e., sufficient room to conduct testing) in conjunction with repair or replacement of the coating/lining. Inspection results that do not satisfy established acceptance criteria will be entered into the corrective action program. The training and qualification of individuals involved in coating/lining inspections of non-cementitious coatings/linings will be conducted in accordance with ASTM International Standards endorsed in RG 1.54 including guidance from the staff associated with a particular standard. For cementitious coatings, training and qualifications will be based on an appropriate combination of education and experience related to inspecting concrete surfaces. The maximum interval of subsequent coating inspections will be consistent with Table 4a of GALL Report AMP XI.M42 in LR-ISG-2013-01, *Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks*.

The program will be implemented no later than six months prior to the period of extended operation.

Baseline coating/lining inspections will be performed in the 10-year period prior to the period of extended operation and begin no later than the six months prior to the period of extended operation. New implementing documents have been developed to support these activities.

NUREG-1801 Consistency

The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks Program is a new program for PNPP that will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M42, *Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks* as revised by LR-ISG-2013-01.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

A review was performed of PNPP operating experience related to Service Level III coatings. In November 2010, the Division 2 Fuel Oil Tank internal surface area was inspected for defects, blistering, missing coating, and loss of material. Several areas of missing or blistering coating material were identified. The areas were reworked to restore the coating.

The elements that comprise the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks Program inspections will be consistent with industry practice. Industry and plant specific operating experience will be considered in the implementation of this program. As additional operating experience is obtained, lessons learned will be incorporated, as appropriate.

Conclusion

The Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks Program will monitor the condition of coatings and linings within mechanical components to ensure degraded coatings do not lead to flow blockage or unanticipated or accelerated corrosion that would result in a loss of component intended function during the period of extended operation. Implementation of the Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks Program will provide reasonable assurance that the effects of aging will be managed such that the coatings will be maintained consistent with the current licensing basis for the period of extended operation. New implementing documents have been developed to support these activities.

B.2.28 LUBRICATING OIL ANALYSIS PROGRAM

Program Description

The Lubricating Oil Analysis Program is an existing condition monitoring program that manages oil environments in order to prevent loss of material and reduction of heat transfer. The program maintains the quality of oil by ensuring contaminants (primarily water and particulates) remain within acceptable limits. The program provides sampling, analysis, and monitoring activities in order to identify detrimental contaminants, such as water and particulates. Water and particulate contaminant levels are trended, and recommendations are made when adverse trends are observed, including in-leakage and corrosion product build-up. Sampling frequencies and acceptance criteria for water and particulate concentrations are consistent with vendor and industry guidelines and may be augmented by PNPP sampling results. Corrective actions are initiated when the component’s oil sample has phase separated water in any amount or water content exceeds an establish limit. This program is credited to provide assurance of the exclusion of water from lubricating oil systems such that materials susceptible to selective leaching are not exposed to water contamination.

The XI.M32, *One-Time Inspection Program* will be used to verify the effectiveness of the Lubricating Oil Analysis Program.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The Lubricating Oil Analysis Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M39 *Lubricating Oil Analysis*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Lubricating Oil Analysis Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Lubricating Oil Analysis Program provides sampling, analysis, and monitoring activities to identify detrimental contaminants, such as water and particulates. Water and particulate contaminant levels are trended, and recommendations are made when adverse trends are observed, including in-leakage and corrosion product build-up.

The following operating experience was identified as applicable.

In May 2013, during the performance of a work order which requires draining the Division 2 Diesel Generator Crankcase Vent, excessive water was unexpectedly found. Approximately 1 1/2 quarts of water was collected prior to isolating the drain valve. Follow-up sampling and investigation concluded that the water was from a previous jacket water leak. Additional sampling resulted in no observed water.

In October 2018, when compared to trends, results from a routine analysis of lubricating oil from the Division 2 Diesel Generator Lubricating Oil Sump indicated an increase in viscosity. The responsible engineer was notified, and it was documented that the lube oil properties remained satisfactory. A maintenance notification was written to change the oil at the next divisional outage.

The history of program-driven identification of degradation and initiation of corrective action prior to loss of intended function, along with subsequent corrective actions, provide assurance that the Lubricating Oil Analysis Program has been effective and will remain effective throughout the period of extended operation.

Conclusion

The Lubricating Oil Analysis Program has been effective at managing aging effects. The program provides reasonable assurance that aging effects are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.2.29 MASONRY WALLS MONITORING PROGRAM

Program Description

The Masonry Walls Monitoring Program is a new condition monitoring program that will manage the effects of loss of material, change in material properties and cracking. The program will rely on periodic visual inspections to monitor and maintain the condition of masonry walls within the scope of license renewal so that the established design basis for each masonry wall remains valid during the period of extended operation.

Nuclear Regulatory Commission (NRC) IE Bulletin (IEB) 80-11, "Masonry Wall Design," and NRC Information Notice (IN) 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11," constitute an acceptable basis for a masonry wall aging management program (AMP). IEB 80-11 required (a) the identification of masonry walls in close proximity to or having attachments from safety-related systems or components and (b) the evaluation of design adequacy and construction practice. NRC IN 87-67 recommended plant-specific condition monitoring of masonry walls and administrative controls to ensure that the evaluation basis developed in response to NRC IEB 80-11 is not invalidated by (a) deterioration of the masonry walls (e.g., new cracks not considered in the reevaluation), (b) physical plant changes such as installation of new safety-related systems or components in close proximity to masonry walls, or (c) reclassification of systems or components from non-safety-related to safety-related, provided appropriate evaluation is performed to account for such occurrences.

The Safety Evaluation Report related to the operation of PNPP, Units 1 and 2, dated May 1982 confirmed that there were no safety related masonry walls in the PNPP following initial construction.

There are no safety related masonry walls that are in close proximity to or having attachments from safety-related systems or components, as such PNPP does not have any safety related masonry walls meeting the criteria of I.E Bulletin 80-11 or IN 87-67. The masonry walls that are within the scope of license renewal at PNPP are limited to isolated non-safety related, non-seismic Category I structures.

The monitoring of masonry walls will be performed under Structures Monitoring Program.

NUREG-1801 Consistency

The Masonry Walls monitoring program will be consistent with the ten elements of aging management program XI.S5, *Masonry Walls*, specified in NUREG-1801. However, the monitoring of masonry walls will be performed under Structures Monitoring Program. The Structures Monitoring Program has been enhanced to include the monitoring of masonry walls within the scope of license renewal.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

There are no safety related masonry walls that are in close proximity to or having attachments from safety-related systems or components, as such PNPP does not have any safety related masonry walls meeting the criteria of I.E Bulletin 80-11 or IN 87-67. The masonry walls that are within the scope of license renewal at PNPP are limited to isolated non-safety related, non-seismic Category I structures.

Since PNPP does not have any safety related masonry walls, there is no documented operating experience at PNPP.

Conclusion

The new Masonry Walls Monitoring Program will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.30 MONITORING OF NEUTRON-ABSORBING MATERIALS OTHER THAN BORAFLEX PROGRAM

Program Description

The Monitoring of Neutron-Absorbing Materials other than Boraflex Program is an existing condition monitoring program that will manage reduction of neutron-absorbing capacity, change in dimensions and loss of material to ensure that aging of the Boral® neutron-absorbing material used in the spent fuel storage racks does not invalidate the spent fuel pool criticality analysis.

The condition monitoring program consists of periodic in-situ inspections and testing of the Boral® panels in the spent fuel pool. Inspections will monitor geometry changes in the Boral® panels caused by blistering, pitting, and bulging. Testing will include areal density measurements of the boron in the Boral® panels. The results will be evaluated against acceptance criteria and previous inspections to determine whether corrective actions are required. If required, appropriate actions will be taken to ensure the required five percent sub-criticality margin is maintained. Monitoring of the Boral® panels in the spent fuel pool will be performed on a ten-year frequency.

NUREG-1801 Consistency

The Monitoring of Neutron-Absorbing Materials other than Boraflex Program is an existing program for PNPP that will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M40, *Monitoring of Neutron-Absorbing Materials other than Boraflex*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Monitoring of Neutron-Absorbing Materials other than Boraflex Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Monitoring of Neutron-Absorbing Materials other than Boraflex Program is an existing program that will manage reduction of neutron-absorbing capacity, change in dimensions and loss of material to ensure that aging of the Boral® neutron-absorbing material used in the spent fuel storage racks does not invalidate the spent fuel pool criticality analysis.

A review of PNPP operating experience, conducted in conjunction with developing the license renewal application, did not identify reduction of neutron-absorbing capacity, change in dimensions, or loss of material for the Boral® neutron-absorbing material used in the spent fuel storage racks.

A response to NRC Generic Letter (GL) 2016-01 was generated by PNPP to demonstrate that credited neutron-absorbing materials in the Spent Fuel Pool of power reactors and the fuel storage pool, reactor pool, or other wet locations designed for the purpose of fuel storage, as applicable, for non-power reactors, are in compliance with the licensing and design basis. PNPP staff satisfied the requirements for a "Category 4" response by providing information on the neutron-absorber material, criticality analysis of record and neutron-absorber monitoring program.

Additional industry OE is captured in NUREG-2191 Section XI.M40 including:

- The coupon testing program at Kewaunee has observed loss of boron-10 areal density of Tetrabor.
- The coupon testing programs at Calvert Cliffs Unit 1 and Crystal River Unit 3 have observed weight loss of sheet-type Carborundum.

The PNPP program does not utilize test coupons nor use neutron absorbing materials of Tetrabor and Carborundum in the spent fuel racks. However, the PNPP program addresses this additional industry OE cited in NUREG-2191 by including Boron-10 areal density measurements in the detection of aging affects and monitoring and trending sections of the program.

As such, industry operating experience considered when developing the PNPP program include blistering, pitting, and bulging.

Conclusion

The Monitoring of Neutron-Absorbing Materials other than Boraflex Program is an existing program for PNPP that will provide reasonable assurance that the aging effects will be adequately managed so that the intended function of the Boral® neutron-absorbing material used in the spent fuel storage racks is maintained consistent with the current licensing basis during the period of extended operation.

B.2.31 NON-EQ ELECTRICAL CABLE CONNECTIONS PROGRAM

Program Description

The Non-EQ Electrical Cable Connections Program is a one-time test program that provides reasonable assurance that the intended functions of the metallic parts of electrical cable connections that are not subject to the environmental qualification requirements of

10 CFR 50.49 and susceptible to age-related degradation resulting in increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation are maintained consistent with the current licensing basis through the period of extended operation.

Cable connectors at PNPP are bolted connections, ring tongue lugs or butt splices, and terminal blocks with insulating material and metallic parts. This AMP focuses on the metallic parts of the electrical cable connections.

The program provides a one-time test, on a sampling basis, to ensure that either aging of metallic cable connections is not occurring and/or that the existing preventive maintenance program is effective such that a periodic inspection program is not required. The one-time test provides additional confirmation to support industry operating experience that shows that electrical connections have not experienced a high degree of failures, and that existing installation and maintenance practices are effective.

NUREG-1801 Consistency

The Non-EQ Cable Connections program is a one-time test that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.E6, *Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Non-EQ Electrical Cable Connections Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Industry operating experience has shown that loosening of connections and corrosion of connections are aging mechanisms that, if left unmanaged, could lead to a loss of electrical continuity and potential arcing or fire. Industry operating experience that forms the basis for this program is included in the operating experience element of the corresponding NUREG-1801 aging management program description.

PNPP operating experience has shown that various connections experiencing increased contact resistance have been detected using thermography, which were corrected without loss of function. All these occurrences were within active components and identified either an imbalance in phases or loose or corroded connections/clamps. The experience demonstrates that thermography has been an effective tool for identifying degraded connections.

In-January 2015, a Condition Report (CR) was written to document a phase imbalance was detected and appropriate maintenance activities were scheduled.

In March 2020, a CR was written to document panel internal testing identified a potential loose connection which was corrected.

In October 2020, a CR was written to document that a high resistance connection of a fuse was scheduled for increased test frequency.

Conclusion

The Non-EQ Cable Connections Program will provide reasonable assurance that aging effects will be managed such that applicable component will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.32 NON-EQ INACCESSIBLE POWER CABLES PROGRAM

Program Description

The Non-EQ Inaccessible Power Cables Program is an existing Cable Aging Management program. The program will, after enhancement, provide reasonable assurance that the intended functions of inaccessible or underground power cables that are not subject to the environmental qualification requirements of 10 CFR 50.49 and exposed to wetting or submergence are maintained consistent with the current licensing basis through the period of extended operation. In-scope power cables (greater than or equal to 400V) in inaccessible or underground locations exposed to significant moisture will be tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be one or more of the following: Dielectric Loss (Dissipation Factor/Power Factor), AC Voltage Withstand, Partial Discharge, Step Voltage, Time Domain Reflectometry, Insulation Resistance and Polarization Index, Line Resonance Analysis, or other testing that is state-of-the-art at the time the tests are performed. The frequency of testing will be established and adjusted based on test results and operating experience.

In addition, after enhancement, periodic actions will be taken to prevent cables from being exposed to significant moisture, defined as periodic exposures to moisture that last more than a few days (e.g., cable wetting or submergence in water). Manholes and underground vaults associated with the in-scope power cables are inspected for water accumulation and the water removed, as necessary.

Inspections for water accumulation and removal occur as needed, based on plant specific operating experience with wetting or submergence. Accumulated water will be removed prior to known or predicted heavy rain or flooding.

After enhancement, dewatering systems (e.g., sump pumps) will be installed, the operation of dewatering devices and alarms will be verified prior to any known or predicted heavy rain or flooding event.

Inspections to verify cable/splices and cable support structures are intact and that dewatering/drainage systems and associated alarms operate properly are performed annually.

The enhancements will be implemented, and initial cable testing completed, no later than six months prior to the period of extended operation.

NUREG-1801 Consistency

The Non-EQ Inaccessible Power Cables Program is an existing PNPP program that, after enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.E3, *Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements*.

Exceptions to NUREG-1801

None

Enhancements

No later than six months prior to the period of extended operation, the following enhancements will be implemented in the following program elements.

Dewatering sump pumps and alarms will be installed in all electrical manholes containing cable with a license renewal intended function. **Program Elements Affected: Preventive Actions (Element 2); Parameters Monitored/Inspected (Element 3)**

Daily operator rounds will confirm that sump pumps and associated alarms are operable. When the high water level alarm has been on two days in a row, the need for supplemental pumps will be evaluated. When high level has occurred three days in a row, supplemental pumps will be used, as needed, and an engineering evaluation of affected power cable ≥400V in that manhole will be performed. The evaluation may use testing as a diagnostic tool but will consider the significance of the inspection results, the functionality of affected component, potential reportability of the event, the extent of the concern, the potential causes for not meeting the inspection criteria, the corrective actions required, and the likelihood of recurrence. **Program Element Affected: Preventive Actions (Element 2)**

Inspections will be conducted at least annually to determine that cables are not wetted or submerged, that cables/splices and cable support structures are intact, and that sump pumps and associated alarms operate properly. **Program Element Affected: Preventive Actions (Element 2)**

Maintenance Plans will be enhanced to ensure all underground in-scope cable ≥400V is tested every six years. **Program Elements Affected: Parameters Monitored/Inspected ((Element 3)**; **Detection of Aging Effects (Element 4)**

Operating Experience

The following operating experience review provides objective evidence that the Non-EQ Inaccessible Power Cables Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

Non-EQ Inaccessible Power Cables Program is an existing Condition Monitoring program. Industry operating experience, including GL 2007-01, has been considered in the implementation of this program.

In March 2022, it was determined that Inaccessible Cable Condition Monitoring needed improvement. A review of historical data related to dewatering inspections of manholes containing cable within the scope of license renewal was conducted. The review concluded that cable dewatering was ineffective in safety-related electrical manholes 1, 2, 3, and 4, and nonsafety-related manhole 7.

An Engineering Change will install dewatering systems (sump pumps) in all five manholes containing cable within the scope of license renewal. Ongoing OE will determine the effectiveness of the enhanced dewatering devices.

Plant operating experience has been reviewed and additional OE occurring during the period of extended operation will be factored into the program via the confirmation and corrective action elements of the PNPP 10 CFR 50 Appendix B quality assurance program.

Conclusion

The Non-EQ Inaccessible Power Cables Program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.33 NON-EQ INSTRUMENTATION CIRCUITS PROGRAM

Program Description

The Non-EQ Instrumentation Circuits Program is a new program that will manage the aging effects of the applicable cables and connections in the neutron monitoring and process radiation monitoring systems or subsystems. The program assures the intended functions of sensitive, high-voltage, low-signal cables exposed to adverse localized equipment environments caused by heat, radiation and moisture will be maintained consistent with the current licensing basis through the period of extended operation. Most sensitive instrumentation circuit cables and connections are included in the instrumentation loop calibration at the normal calibration frequency, which provides sufficient indication of the need for corrective actions based on acceptance criteria related to instrumentation loop performance. The review of calibration results will be performed once every ten years, with the first review occurring no later than six months prior to the period of extended operation.

For sensitive instrumentation circuit cables that are disconnected during instrument calibrations, testing using a proven method for detecting deterioration for the insulation (such as insulation resistance tests or time domain reflectometry) will occur at least once every ten years, with the first test occurring no later than six months prior to the period of extended operation. Applicable industry standards and guidance documents will be used to delineate the program.

The first surveillance review or insulation resistance (IR) testing will be completed no more than six months prior to the period of extended operation.

NUREG-1801 Consistency

The Non-EQ Instrumentation Circuits Test Review Program is a new PNPP program that will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.E2, *Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience review provides objective evidence that the Non-EQ Instrumentation Circuits Test Review Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Non-EQ Instrumentation Circuits Program is a new program. Industry operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is executed and will be factored into the program via the confirmation and corrective action elements of the PNPP 10 CFR 50 Appendix B quality assurance program.

A review of PNPP's operating experience of the past 10 years did not identify any age-related failures or unique aging mechanisms not addressed in NUREG-1801. The review of OE from 2013 to 2023 found the following related to instrument cable within the scope of license renewal:

In April 2013, a Condition Report (CR) was written to document calcium buildup on IRM D connector/cable guard causing spiking. Connector was cleaned and retested satisfactorily.

In March 2015, a CR was written to document a failure of IRM B during channel check. Investigation identified I/V plots showed the detector caused spiking. The connector has reached the end of its EQ qualified life and is considered to have contributed to the failure. The detector and connector were replaced in Refuel Outage 15 (1R15).

In April 2015, a CR was written to document cable 2C-08-41 failed continuity test. The cable was replaced, and work completed July 2015.

In April 2015, a CR was written to document IRM A failed overlap test. The Range Switch Card failed. The card was replaced, and order closed August 2015.

In April 2017, a CR was written to document IRM D indication erratic. Found the cables had been tied out of the way for access to other undervessel work. IRM D tested satisfactorily when cables were restored.

Conclusion

The Non-EQ Instrumentation Circuits Program will provide reasonable assurance that aging effects will be managed such applicable components will continue to perform their intended function consistent with the current licensing basis during the period of extended operation.

B.2.34 NON-EQ INSULATED CABLES AND CONNECTIONS PROGRAM

Program Description

The Non-EQ Insulated Cables and Connections Program is an existing Cable Aging Management program which includes the Cable Monitoring program that provides reasonable assurance that the intended functions of insulated cables and connections exposed to adverse localized environments caused by temperature, radiation, or moisture can be maintained consistent with the current licensing basis through the period of extended operation. The program provides for the periodic visual inspection of accessible, non-environmentally qualified electrical cables and connections, in order to determine if age-related degradation is occurring. Accessible electrical cables and connections installed in adverse localized environments are visually inspected for signs of age-related degradation such as embrittlement, discoloration, cracking, melting, swelling, or surface contamination.

The program is existing. The visual inspections will be performed on a 10-year interval, with the first inspection completed no later than six months prior to the period of extended operation.

NUREG-1801 Consistency

The Non-EQ Insulated Cables and Connections Program is an existing PNPP program that, after enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.E1, *Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements*.

Exceptions to NUREG-1801

None

Enhancements

The following enhancement will be implemented no later than six months prior to the period of extended operation:

The program will be enhanced to include a plant-specific procedure for plant walkdowns of adverse localized environments.

Operating Experience

The following operating experience examples provide objective evidence that the Non-EQ Insulated Cables and Connections Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Non-EQ Insulated Cables and Connections Program is an existing Condition Monitoring program. Industry operating experience has been considered in the implementation of this program. Plant operating experience has been reviewed and additional OE occurring during the period of extended operation will be factored into the program via the confirmation and corrective action elements of the PNPP 10 CFR 50 Appendix B quality assurance program.

As stated in NUREG-1801, XI.E1, industry operating experience has shown that adverse localized environments caused by heat, radiation, or moisture for electrical cables and connections may exist near steam generators, pressurizers, or hot process pipes, such as feedwater lines. In this industry experience, such adverse localized environments have caused degradation of insulating materials on electrical cables and connections that is visually observable, such as color changes or surface cracking. These visual indications can indicate cable degradation. The examination techniques used in this program to detect aging effects are proven industry techniques that have been effectively used at PNPP in other programs.

Accordingly, there is reasonable assurance that this aging management program will be effective during the period of extended operation.

Conclusion

The Non-EQ Insulated Cables and Connections Program will be capable of managing aging effects due to heat, moisture, and radiation in the presence of oxygen, for non-environmentally qualified cables and connections. The program, after enhancement, will provide reasonable assurance that aging effects will be managed such that the applicable components continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.35 ONE-TIME INSPECTION PROGRAM

Program Description

The One-Time Inspection Program is a new program that will include a one-time inspection of selected components to verify the effectiveness of the Fuel Oil Chemistry, the Lubricating Oil Analysis, and the Water Chemistry programs which are designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. The One-Time Inspection Program provides inspections that verify that unacceptable degradation is not occurring. It also may trigger additional actions that ensure the intended functions of affected components are maintained during the period of extended operation.

The elements of the program include (a) determination of the sample size of components to be inspected based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience,(b) identification of the inspection locations in the system or component based on the potential for the aging effect to occur, (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined, and (d) an evaluation of the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the period of extended operation.

The inspection includes a representative sample of the system population and focuses on the bounding or lead components most susceptible to aging due to time in service, and severity of operating conditions. A representative sample size is 20% of the population (defined as components having the same material, environment, and aging effect combination) or a maximum of 25 components. Otherwise, a technical justification of the methodology and sample size used for selecting components for one-time inspection will be included as part of the program’s documentation.

The program relies on established NDE techniques, including visual, ultrasonic, and surface techniques. Inspections will be performed by personnel qualified in accordance with site procedures and programs to perform the type of examination specified. For American Society of Mechanical Engineers (ASME) Code components, examinations will follow procedures consistent with the ASME Code and 10 CFR 50 Appendix B. For non-code components, examinations will follow site procedures that include requirements for items such as lighting, presence of protective coatings, and cleaning processes that ensure an adequate examination. Acceptance criteria will be based on applicable ASME or other appropriate standards, design basis information, or vendor-specified requirements and recommendations.

The program cannot be used for structures or components with known age-related degradation mechanisms or when the environment in the period of extended operation is not expected to be equivalent to that in the prior 40 years. Periodic inspections should be proposed in these cases.

The program does not address Class 1 piping less than nominal pipe size (NPS) 4. That piping is addressed in AMP XI.M35, *One Time Inspection of ASME Code Class 1 Small Bore-Piping.*

The inspections will be completed within 10 years of, but no later than six months prior to the period of extended operation.

NUREG-1801 Consistency

The One-Time Inspection Program is a new program for PNPP that will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M32, *One-Time Inspection*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience review provides objective evidence that the One-Time Inspection Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The elements that comprise inspections associated with this program (the scope of the inspections and inspection techniques) are consistent with the program description in NUREG-1801 which is based on industry operating experience and approved industry techniques for inspections such as UT and visual exams.

Operating experience for select components and environments within the scope of the One-Time Inspection Program were evaluated to ensure use of a one-time inspection was appropriate. Review of the PNPP operating experience did not identify any instances of degradation that were caused by an ineffective chemistry program.

The One-Time Inspection Program is a new program that will include a one-time inspection of selected components to verify the effectiveness of the Fuel Oil Chemistry, the Lubricating Oil Analysis, and the Water Chemistry programs.

Conclusion

The one-time inspection program will provide reasonable assurance that the aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.36 ONE-TIME INSPECTION OF ASME CODE CLASS 1 SMALL BORE-PIPING PROGRAM

Program Description

The one-time inspection of ASME Code Class 1 small-bore piping aging management program is a new condition monitoring program that will manage cracking of piping in a reactor coolant environment. The program will perform one-time inspection of a sample of ASME Code Class 1 piping less than 4-inches nominal pipe size (NPS) and greater than or equal to 1-inch NPS. The program includes pipes, fittings, branch connections, full penetration (butt) welds and partial penetration (socket) welds.

Cracking of ASME Code Class 1 small-bore piping due to stress corrosion cracking, cyclical (including thermal, mechanical, and vibration fatigue) loading, thermal stratification or thermal turbulence has not been experienced at PNPP. Therefore, this one-time inspection program is applicable and adequate to manage this aging effect during the period of extended operation. Program inspections will augment ASME Code, Section XI requirements.

For the current fourth 10-year interval, the ISI program applies the requirements of ASME Code, Section XI, 2013 Edition. Any deviation from ASME Code, Section XI requirements must be approved by the NRC per a relief request. The current ISI program for the fourth 10-year interval includes periodic volumetric ultrasonic testing of selected Class 1 small-bore piping butt welds. The One-time Inspection of ASME Code Class 1 Small-Bore Piping program will also include inspection of socket welds using a volumetric examination technique demonstrated to be capable of detecting cracking.

PNPP has been operating for more than 36 years at the time of the license renewal application submittal. According to the guidance of the GALL Revision 2, section XI.M35, the inspection sample size will be at least 3 percent of the population of program butt welds with a maximum of 10 program butt welds and at least 3 percent of the population of program socket welds with a maximum of 10 program socket welds.

PNPP's ASME Code Class 1 piping weld population for piping with an NPS less than 4" and greater than or equal to an NPS of 1" consists of 77 full penetration welds and approximately 400 partial penetration (socket) welds. Therefore, the full penetration weld sample size will be 3 (77 x 0.03 rounded up to the nearest whole unit) and the socket weld sample size will be 10. For socket welds, opportunistic destructive examination may be performed in lieu of volumetric examination. Because more information can be obtained from a destructive examination than from nondestructive examination, each destructive examination will be considered equivalent to having volumetrically examined two socket welds.

These weld inspections will ensure an adequate sample size to provide confidence that the aging effect of cracking is not an issue at PNPP. Sample locations will be selected based on susceptibility for cracking due to stress corrosion cracking and fatigue, consequence of failure, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small bore piping locations.

If evidence of cracking is revealed by this one-time inspection, it will be entered into the Corrective Action Program to determine extent of condition, and a follow-up periodic plant-specific aging management program (AMP) will be implemented.

One-time inspections will be completed within the six year period prior to the period of extended operation and no later than six months prior to the period of extended operation.

NUREG-1801 Consistency

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program is a new program for PNPP that will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M35, *One-Time Inspection of ASME Code Class 1 Small-Bore Piping*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience review provides objective evidence that the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The operating experience relative to the new one-time inspection of ASME Code Class 1 Small-Bore Piping Program did not identify any evidence of cracking in any piping less than 4-inches nominal pipe size (NPS) and greater than or equal to 1-inch NPS. The ASME Section XI Inservice Inspections, Subsections IWB, have been consistently implemented at PNPP since the start of operations. The history of effective implementation of the inservice inspection program at PNPP provides assurance that the inspections performed for the one-time inspection of ASME Code Class 1 small-bore piping aging management program will be effective at identifying potential deficiencies.

Conclusion

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will provide reasonable assurance that the aging effect of cracking will be adequately managed so that the intended functions of components within the scope of license renewal are maintained consistent with the current licensing basis during the period of extended operation.

B.2.37 OPEN-CYCLE COOLING WATER SYSTEM PROGRAM

Program Description

The open-cycle cooling water (OCCW) systems program is an existing program that manages material loss due to micro- or macro-organisms and various corrosion mechanisms to ensure effective transfer of heat from safety-related structures, systems and components (SSCs) to the ultimate heat sink (UHS). At PNPP, raw water for heat transfer to safety related SSCs is accomplished with the emergency service water (ESW) system. The program relies on the implementation of the recommendations of the Nuclear Regulatory Commission (NRC) Generic Letter (GL) 89-13 to ensure that the effects of aging on the OCCW systems will be managed for the period of extended operation. In accordance with the guidance of GL 89-13, other components are also managed under OCCW based on exposure to a raw water environment and the aging management review. The OCCW program manages aging affects by using a combination of preventive, condition, and performance monitoring activities. These actions include (a) surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the OCCW system or structures and components serviced by the OCCW system; (b) inspection of critical components for signs of corrosion, erosion, and biofouling; and (c) testing of the heat transfer capability of heat exchangers that remove heat from components important to safety. AMP XI.M17, *Flow-Accelerated Corrosion*, manages the aging effects caused by pipe and piping component wall thinning. AMP XI.M21A, *Closed Treated Water Systems*, manages closed cooling water systems.

Loss of material due to recurring internal corrosion has been identified for the Emergency Service Water (ESW) system. Loss of material due to recurring internal corrosion and erosion is managed by augmented inspections utilizing the XI.M17, *Flow Accelerated Corrosion* program. The XI.*S7 RG 1.127, Inspection of Water Control Structures Associated* *with Nuclear Power Plant* aging management program is credited with silt removal from the multi-port intake structure through the ESW pumphouse, including intake and alternate intake tunnels, associate tunnel riser shafts, discharge tunnel, and discharge structure. AMP XI.M21A, *Closed Treated Water Systems*, manages closed cooling water systems. AMP XI.M41, *Buried and Underground Piping and Tanks*, manages aging effects for underground ESW piping. These activities are not managed by this program.

ESW system components are unlined. The recommendations of LR-ISG-2013-01 to include recommendations of LR-ISG-2013-01 section XI.M42, *Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks* do not apply.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The open-cycle cooling water (OCCW) systems program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M20, *Open-Cycle Cooling Water* and additional guidance in LR-ISG-2012-02.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Open-Cycle Cooling Water Systems Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

A review of plant specific PNPP operating experience since 2013, was conducted through a search of plant corrective action program documents identified condition reports potentially identifying operating experience related to the OCCW aging management program. The review shows the guidance of NRC GL 89-13 has been effective in managing aging effects due to biofouling, corrosion, erosion, protective coating failures, and silting in structures and components serviced by OCCW systems.

Annual diving inspections have effectively ensured the intake and discharge structures continue to control mussel contamination within acceptable limits. No evidence of Asian clams has been identified. There have been no documented instances of mussel infestation in ESW system piping or safety-related heat exchangers served by the system. The lack of documented instances indicates that the existing program has been effective in managing aging effects due to biofouling and silting in structures and components serviced by OCCW systems.

Periodic heat exchanger performance tests ensure the effective transfer of heat from safety-related structures, systems and components (SSCs) to the ultimate heat sink (UHS). No unacceptable performance has been documented.

- In April 2013, a Condition Report (CR) documented that the ECC B heat exchanger divider plate was found to have a wall thickness that appeared to be less than allowable. Extent of condition found the ECC A heat exchanger acceptable. An engineering review of calculations and divider plate condition concluded there was some wall thinning that was acceptable for the period leading to the next scheduled inspection.

- In February 2022, a CR documented that of a heat sink self-assessment identified that the Division 1 diesel generator jacket water heat exchanger had a degrading trend in performance and as a result, corrective actions were established to ensure cleaning and restoration of margin in the heat transfer coefficient.

- In March 2023 two CRs documented that fouling in RHR heat exchangers was observed during cleaning, demonstrating that, while fouling occurs, site practices are effective at identifying and controlling the fouling before unacceptable heat exchanger performance occurs.

AMP XI.M17, *Flow-Accelerated Corrosion*, manages the aging effects caused by pipe and piping component wall thinning and corrosion. This includes identification of internal erosion and corrosion of valve bodies, piping, piping components and piping elements. A review of the OE potentially related to the XI.M20 OCCW aging management program and of the OE potentially related to the XI.M17 program was conducted. Operating experience with the applicable principal aging mechanisms are identified below.

Through wall leaks – aging mechanism internal corrosion

- Through wall, or pinhole, leaks are usually the result of corrosion over time, at unpredictable locations in a piping system. No evidence of recurring leaks in a single location have been found, though a very few occasions have noted an increased leak rate at a known leak location prior to repair. None of the leaks resulted in degraded performance. Numerous instances have been documented of pipe leaks or blockage due to corrosion between 2013 and 2022 related to XI.M20 or XI.M17.

- In August 2017 a CR documents that a leak was identified in ESW piping near ECC heat exchanger B. An evaluation determined the leak was a pinhole leak rather than cracking. The extent of the leak did not affect operability. A clamp was applied to contain the leak until repairs could be accomplished. Another leak in the vicinity prompted an extent of condition evaluation which found the other areas to be satisfactory. This section of pipe was removed and eliminated by design in Refuel

Outage (RFO) 17 so it could not happen again, and the same piece in the "A" loop was eliminated in RFO 18.

- The XI.M17 walkdown process is effective in identifying leaks and the management and repair of those leaks have demonstrated the program will be effective throughout the period of extended operation. The XI.M20 program does not need to be enhanced for this aging effect.

Wall thinning – aging mechanism internal erosion.

- Wall thinning occurs as a result of erosion by corrosion products suspended in the fluid, high velocity or high pressure flow. Thinning occurs most often at points where the piping system turns or where piping opens into a waterbox of some kind, impacting a localized surface within the waterbox. Numerous instances have been documented of wall thinning or flange or valve seat leaks due to erosion from 2013 through 2021.

- In April 2018 a CR documented that a through-wall pipe leak was discovered on ESW 'A' piping at the outlet of the RHR 'A' heat exchangers. The leak was identified between valves 1P45F550A (RHR A/C HX'S ESW OUTLET) and 1P45F0068A (RHR A HX'S ESW OUTLET VALVE) on 20" piping beneath piping insulation. The leak did not affect operability.

- In July 2018 a CR documented that a UT examination as part of the FAC program extent of condition evaluation for a condition report found localized wall thinning. While the amount of wall thinning was acceptable, a 30-day UT monitoring plan was instituted to determine the rate of thinning. Replacement of the elbow occurred in the next refueling outage.

- The XI.M17 ultrasonic examination process is effective in identifying wall thinning and management or repair of the condition to ensure no loss of function. These actions have demonstrated the program will be effective throughout the period of extended operation. The XI.M20 program does not need to be enhanced for this aging effect.

Other aging mechanisms, such as external corrosion, have been isolated instances that were identified in system walkdowns and tracked or repaired using the corrective action program.

The XI.M20 program, in conjunction with the XI.M17 and XI.M41 programs have been effective in managing aging effects due to biofouling, corrosion, erosion, protective coating failures, and silting in structures and components serviced by OCCW systems.

Conclusion

The Open-Cycle Cooling Water System program will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis during the period of extended operation.

B.2.38 PROTECTIVE COATING MONITORING AND MAINTENANCE PROGRAM

Program Description

The Protective Coating Monitoring and Maintenance Program is an existing condition monitoring program that manages the effects of loss of coating integrity of Service Level I coatings inside the containment. The program assesses coating conditions through visual inspections. The failure of the Service Level I coatings could adversely affect the operation of the emergency core cooling systems (ECCS) by clogging the ECCS suction strainers.

The PNPP ECCS suction strainer is designed using the guidance in the Boiling Water Reactors Owners Group Utility Resolution Guidance (BWROG URG) document with a robust capacity for post-accident debris loading. Energy Harbor has also implemented foreign material exclusion (FME) procedures to limit the potential for clogging the ECCS suction strainer.

Also, the ASME Section XI, Subsection IWE Program is credited for aging management of the containment and includes periodic visual examinations of the steel containment internal surfaces for signs of degradation, assessment of damage, and corrective actions. Acceptance criteria include no gross flaking, peeling, or blistering of coatings, and no excessive debris accumulation.

Service Level I protective coatings for steel components are not credited for managing the aging effect of loss of material due to corrosion. Proper monitoring and maintenance of protective coatings inside containment ensures operability of post-accident safety systems that rely on water recycled through the containment. The proper monitoring and maintenance of Service Level I coatings ensures there is no coating degradation that would impact safety functions, for example, by clogging the emergency core cooling system suction strainer.

The program with enhancement will be continued for the period of extended operation.

NUREG-1801 Consistency

The Protective Coating Monitoring and Maintenance Program is an existing PNPP program that, with enhancements, is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.S8, *Protective Coating Monitoring and Maintenance Program*.

Exceptions to NUREG-1801

None

Enhancements

The existing PNPP Protective Coating Monitoring and Maintenance Program will be enhanced to comply with the requirements of ASTM D5163-08.

The above enhancement will be implemented no later than six months prior to the period of extended operation.

Operating Experience

The following operating experience examples provide objective evidence that the Protective Coating Monitoring and Maintenance Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Protective Coating Monitoring and Maintenance Program detects aging effects using visual techniques to detect and characterize flaws. These techniques are widely used in the industry and have been demonstrated effective at detecting aging effects during inspections. The application of these proven industry methods provide assurance that the effects of aging will be managed such that the Protective Coating Monitoring and Maintenance Program components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The PNPP drywell is required to be cleaned and inspected for cleanliness prior to drywell close-out.

Also, the ASME Section XI, Subsection IWE Program is credited for aging management of the containment and includes periodic visual examinations of the steel containment internal surfaces for signs of degradation, assessment of damage, and corrective actions. Acceptance criteria include no gross flaking, peeling, or blistering of coatings, and no excessive debris accumulation.

As reported in the inservice inspection summary report for Cycle 14 (June 7, 2011, to May 16, 2013), general visual examination of the containment and drywell interior and exterior surfaces was performed prior to and during the Cycle 14 refueling outage. Some areas of minor coating degradation were identified and documented on condition reports.

During the Cycle 14 refueling outage, drywell exterior and containment interior Appendix J examinations were performed. Areas with degraded coatings were identified. No structural issues were identified. None of the areas with degraded coatings had anything more than very minor surface rust. Corrective actions were initiated to touch up the degraded coating.

In October 2012 and in November 2012, two condition reports identified numerous areas with degraded coatings (e.g., chipped, cracked or peeling paint, rust, etc.). Many of the degraded areas were previously identified when Containment ISI examinations were last performed prior to Refuel Outage 12 (1R12) and others were new. For this noted condition none of the rusted/degraded areas exhibited any significant material loss and were well within the 10% wall thickness reduction tolerance of ASME Code. As such, the noted condition had no impact on containment integrity and the metal Containment conformed to ASME Code requirements. Corrective actions were taken as appropriate.

Conclusion

The Protective Coating Monitoring and Maintenance Program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.39 REACTOR HEAD CLOSURE STUD BOLTING PROGRAM

Program Description

The Reactor Head Closure Stud Bolting Program is an existing condition monitoring and preventive program that provides for ASME Section XI inspections of reactor head closure studs, nuts, flange threads and washers for cracking and loss of material.

The Reactor Head Closure Studs Program examines reactor vessel stud assemblies in accordance with the examination and inspection requirements specified in the ASME B&PV Code, Section XI, Subsection IWB and approved ASME Code Cases. The extent and schedule for examining and testing the reactor head closure studs, nuts, flange threads, and washers is specified in Table IWB- 2500-1 for B-G-1 components, *Pressure Retaining Bolting Greater than 2 Inches in Diameter*. The flange threads and studs receive a volumetric examination, and the surfaces of nuts and washers are inspected using a VT-1 examination. All pressure-retaining boundary components in Examination Category B-P receive a visual VT-2 examination during the system pressure test.

In addition, the Reactor Head Closure Stud Bolting program includes the preventive measures to mitigate cracking described in the NUREG-1339, *Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*, and NRC Regulatory Guide 1.65, Revision 0, *Materials and Inspection for Reactor Vessel Closure Studs*, with the exception that PNPP stud assemblies are assumed to have an actual yield strength of greater than 150 kilo-pounds per square inch (ksi). There is no metal plating applied to the closure studs, nuts or washers. A phosphate coating is applied to threaded areas of the studs and nuts and bearing areas of the nuts and washers to act as a rust inhibitor and to assist in retaining lubricant (either graphite/alcohol or nickel powder base lubricant) on these surfaces. A stable lubricant that does not contain molybdenum disulfide is applied to the nuts, threads and all bearing surfaces of the nuts and washers prior to reactor vessel head re-installation.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The Reactor Head Closure Stud Bolting Program, with enhancements, will be consistent with the program as described in NUREG-1801, Section XI.M3, *Reactor Head Closure Stud Bolting*, with one exception.

Exceptions to NUREG-1801

NUREG-1801, as a preventive action, recommends use of bolting materials for closure studs that has an actual measured yield strength less than 150 kilo-pounds per square inch (ksi). The PNPP stud assembly material is SA 540 Grade B23 or B24 carbon steel, Class 3. The stud assemblies are assumed to have an actual yield strength of greater than 150 ksi and therefore, PNPP manages the aging effect of cracking for these high strength low alloy steel materials. **Program Elements Affected: Preventive Actions. (Element 2)**

Justification for Exception

The Reactor Head Closure Studs Program examines reactor vessel stud assemblies in accordance with the examination and inspection requirements specified in the ASME B&PV Code, Section XI, Subsection IWB and approved ASME Code Cases. The extent and schedule of these examinations provide for timely detection of cracks. There have been no recordable indications of cracking identified by ISI Program examination of reactor head closure studs, indicating that the current program has been effective in managing cracking.

Preventive measures listed in NUREG-1801 Section XI.M3**,** *Reactor Head Closure Stud Bolting*, that can reduce the potential for cracking are met by the PNPP Reactor Head Closure Studs Program. These include (1) metal-plated studs are not used, which could cause degradation due to corrosion or hydrogen embrittlement; and (2) an approved stable lubricant is applied to the studs whenever the reactor head is reinstalled. The lubricant used does not contain molybdenum disulfide (MoS_2), which has been shown to be a potential contributor to SCC.

Therefore, the 150 ksi maximum actual yield strength preventive measure is not necessary to provide reasonable assurance that the reactor head closure studs can perform their intended function consistent with the current licensing basis through the period of extended operation.

Enhancements

No later than six months prior to the period of extended operation, the following enhancement will be implemented in the following program element:

The purchasing requirements for reactor head closure stud material will be revised to assure that any studs procured in the future will have measured yield strength of less than 150 ksi. Program Element Affected: Preventive Actions. (Element 2)

Operating Experience

The following operating experience examples provide objective evidence that the Reactor Head Closure Stud Bolting Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Reactor Head Closure Studs Program detects aging effects using nondestructive examination (NDE) visual and volumetric techniques to detect and characterize flaws. These techniques are widely used and have been demonstrated effective at detecting aging effects during inspections performed to meet ASME Section XI Code requirements.

A review of plant-specific operating experience since 2013, through a search of plant Corrective Action Program documents found no evidence of unacceptable indications for any reactor head closure studs, threads in flange, nuts, or washers.

The Refueling Outage 18 (RFO18) ISI Summary Report identified no unacceptable reactor head closure studs, threads in flange, nuts, or washers.

Conclusion

The Reactor Head Closure Studs Program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis during the period of extended operation.

B.2.40 REACTOR VESSEL SURVEILLANCE PROGRAM

Program Description

The Reactor Vessel Surveillance Program is an existing condition monitoring program that manages the loss of fracture toughness due to neutron irradiation embrittlement for reactor vessel beltline materials using material data and dosimetry. The program meets the requirements of 10 CFR 50, Appendix H.

The Reactor Vessel Surveillance Program is part of the BWRVIP Integrated Surveillance Program (ISP) described in BWRVIP-86, Revision 1-A and approved by the NRC. The schedule for removing surveillance capsules is in accordance with the timetable specified in BWRVIP-86, Revision 1-A. The PNPP 183° surveillance capsule, designated as an ISP(E) capsule, is scheduled for withdraw and testing in the period of extended operation at approximately 40 EFPY.

Surveillance capsule testing and reporting, to the extent practicable, is performed in accordance with the requirements of American Society for Testing and Materials (ASTM) E 185 Standard. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation. Untested capsules placed in storage must be maintained for future insertion.

The program is a condition monitoring program that measures the increase in Charpy V-notch 30 foot-pound (ft-lb) transition temperature and the drop in the upper shelf energy as a function of neutron fluence and irradiation temperature. The data from this surveillance program are used to monitor neutron irradiation embrittlement and are used to support upper shelf energy and pressure-temperature limit calculations.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The Reactor Vessel Surveillance Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M31, *Reactor Vessel Surveillance*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following operating experience review provides objective evidence that the Reactor Vessel Surveillance Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The Reactor Vessel Surveillance Program is part of the BWRVIP Integrated Surveillance Program (ISP) described in BWRVIP-86, Revision 1-A and approved by the NRC. The schedule for removing surveillance capsules is in accordance with the timetable specified in BWRVIP-86, Revision 1-A. The PNPP 183° surveillance capsule, designated as an ISP(E) capsule, is scheduled for withdraw and testing in the period of extended operation at approximately 40 EFPY.

The program provides sufficient material data and dosimetry to (a) monitor irradiation embrittlement at the end of the period of extended operation and (b) determine the need for operating restrictions on the inlet temperature, neutron fluence, and neutron flux.

Since 2013 the OE database for condition reports associated with AMP XI.M31 was searched, and no condition reports were identified.

Conclusion

The Reactor Vessel Surveillance Program has been demonstrated to be capable of managing loss of fracture toughness due to neutron irradiation embrittlement for reactor vessel beltline materials. The Reactor Vessel Surveillance Program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.2.41 RG 1.127, INSPECTION OF WATER-CONTROL STRUCTURES ASSOCIATED WITH NUCLEAR POWER PLANTS PROGRAM

Program Description

PNPP's commitment to implement Regulatory Guide (RG) 1.127 Revision 1 in the current license basis is limited to the service water intake and discharge control structures. The RG 1.127, *Inspection of Water-Control Structures Associated with Nuclear Power Plants Program* is an existing condition monitoring program. The existing program consists of periodic inspections based on Regulatory Guide (RG) 1.127, Rev. 1 guidance for the intake and discharge control structures, the associated intake and discharge tunnels, and other water-control structures associated with the emergency service water (ESW) system. Program inspections include concrete and steel structures and components associated with the ESW system, predominantly from the multi-port intake structure through the ESW pumphouse, including intake and alternate intake tunnels, associated tunnel riser shafts, sluice gates, screens, discharge tunnel, and discharge structure.

The program will be enhanced to include managing aging effects associated with the ESW swale, and the flood mitigation features of the major stream, remnant minor stream, and the diversion stream channel.

NUREG-1801 Consistency

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program is an existing PNPP program that, with enhancement, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.S7 *RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants*.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented in the identified program elements no later than six months prior to the period of extended operation.

Scope (Element 1)

The scope of this program will be enhanced to manage aging effects associated The scope of the program will be enhanced to manage aging effects associated with the ESW swale, and the flood mitigating features of the major stream, major stream culvert, remnant minor stream, and the diversion stream channel and diversion stream berm. The program implementing procedure will also include a listing of these earthen structures that are within the scope of license renewal. The program implementing procedure will also include a listing of existing procedures/instructions that are credited to manage the aging effects of water control structures that are within the scope of this aging management program. Parameters monitored will include settlement, depressions, sink holes, slope stability (e.g., irregularities in alignment and variances from originally constructed slopes), seepage, proper functioning of drainage systems, and degradation of slope protection features.

The aging effects associated with concrete are loss of material, cracking, and various changes in material properties (that is, loss of bond, increase in porosity and permeability, reduction of strength, and differential settlement). The aging effects associated with earthen structures (rock, stone and soil) are loss of form and loss of material. The aging effects associated with wooden clamps supporting the electrical cables in manholes are change in material properties due to weathering, chemical degradation, insect infestation, repeated wetting and drying, fungal decay.

Preventive Actions (Element 2)

Revise plant procedures to include the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 kilo-pounds per square inch (ksi)).

Revise plant procedures to include the preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.

Parameters Monitored/Inspected (Element 3)

The program will be enhanced to include monitoring and inspection of the major stream culvert, and the flood mitigation features of the major stream, remnant minor stream, the diversion stream berm and channel, and the ESW swale. The program implementing procedure will also include a listing of these earthen structures that are within the scope of license renewal. The program implementing procedure will also include a listing of existing procedures/instructions that are credited to manage the aging effects of water control structures that are within the scope of this aging management program. Parameters monitored will include settlement, depressions, sink holes, slope stability (e.g., irregularities in alignment and variances from originally constructed slopes), seepage, proper functioning of drainage systems, and degradation of slope protection features.

Steel components are monitored for rust, erosion, corrosion, cavitation and weld cracks.

Detection of Aging Effects (Element 4)

The program will be enhanced to include monitoring and inspection of earthen embankment structures associated with the major stream, remnant minor stream and the new diversion stream channel including the inline spillway structure at the outfall of the new channel.

The berm inspections will include the following items:

a) Identify if there are any wet areas, erosion, or slides
b) Identify if there are obstructions in the stream that could partially block or prevent flow
c) Identify bare spots needing re-vegetation
d) Locate any riprap or erosion protection that has been displaced
e) Identify cracks that may indicate potential excessive settlement (>1 foot) or slope instability
f) Identify any burrowing rodent holes that could impact the performance or stability of the berm

Operating Experience

The following operating experience examples provide objective evidence that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program consists of periodic inspections based on RG 1.127, Rev. 1 for the tunnels and other water-control structures associated with emergency service water (ESW).

An underwater inspection of the intake tunnel and vertical shafts was conducted in August 2008. The inspection identified an average sediment depth in the main intake tunnel between 12" and 15", with an isolated maximum depth of about 35" and 60" near the service water pumphouse and the 'T' intersection in the lake respectively. No signs of gross structural damage were noted. The reported condition is the same as/similar to the result of the 2003 inspection and there was no major change in the tunnel condition, both from a structural and hydrodynamic point of view. The tunnels are considered capable of providing cooling water for both normal operation as well as for accident/emergency operation, including water use for fire protection.

In August 2014 an underwater inspection with aid of a remotely operated vehicle (ROV) was conducted on the Emergency Service Water (ESW) Normal Intake tunnel, Service Water (SW) and Common tunnels for structural integrity and blockage. No signs of any major crack, spalls or any other deficiencies with the concrete liner or bedrock were detected. The maximum silt and zebra mussel blockage were reported to be less than 3 feet in the ESW Normal Intake tunnel. The maximum silt and zebra mussel blockage were reported to be less than 5 feet in the SW and common tunnels. The location of the 5 feet of blockage was at the tee located prior to the intake risers. The reported silt depths in the tunnel are within the acceptable level and do not challenge the capacity of the tunnel to provide cooling water to the plant.

In January 2016, during the weekly inspection of the new Flood Diversion Channel it was noted that several areas of soil erosion have developed on the channel outfall bank (photos attached in the Condition Report). The outfall was still functional, but a review of the degraded areas was required. The cause was due to the late season construction, as a result of which the vegetative growth, required to stabilize the area, was not complete. The excessive rainfall during the Dcember-26 through Decembet-28, 2015 period resulted in the identified erosion. Corrective actions were completed per a work order. Additionally, Chemistry performs inspections (part of environmental site inspections) of streams to monitor erosion concerns and corrective actions are taken to restore the design configuration of the streams, as required.

In August 2015, a diving inspection of the Emergency Service Water (ESW) Normal Intake tunnel was performed. During the inspection, it was reported that there was a build-up of silt and zebra mussels of approximately 6 feet along the entire length of the tunnel and a max build-up of 7 feet. A work order was initiated to pump out the silt in the ESW Intake Tunnel and the work was completed as detailed in the work order.

In October 2015, a diving inspection of the ESW Normal Intake Tunnel was performed for post zebra treatment. The dive team identified an additional debris buildup of Zebra Mussel Shell, for approximately 40' (200' mark to the 240' mark), depth of the 7' respectively and tapering down to approximately 2' and less at the Y to the Common Tunnel. A work order was initiated to remove sediment to an acceptable level from the ESW Tunnel and the work was completed as detailed in the work order.

In September 2018, a diving inspection of the ESW East and West Pump Bay and the Forebay was performed. Silt levels in the Emergency Service Water Pumphouse (ESWPH) East and West Pump Bays were found to be over 3 feet in depth. Work order operations state that if levels currently exceed 3 feet for any location in the ESWPH Pump Bay, then initiate a condition report to evaluate silt/zebra mussel debris condition for determining if a 6’ depth will be reached prior to the next inspection.

The silt level in the ESWPH Forebay was found to be over 3 feet in depth in a single isolated location (3.5 feet). Work order operation states that if levels currently exceed 3 feet for any location in the ESWPH Forebay, then initiate a condition report for engineering evaluation. Work orders were initiated to inspect ESWPH Forebay & Normal Intake Tunnel and contingent steps for silt removal which was required. Corrective actions were taken. Work was completed and details of work completed are documented in the work orders.

In May 2019, July 2020, and May 2021, it was noted that erosion had occurred at the base of the Security perimeter fence along the east side of the plant's Protected Area. The erosion was located along the west bank of the Remnant Minor Stream, localized to the vicinity of the east storm drain system headwall. The cause of the erosion was indeterminant but was likely due to overland runoff occurring at this localized topographic low point which had minimal stabilizing vegetation along the sloped bank of the stream channel. The erosion had caused a void area to form under the security fence line as well as erosion rills to the north and south of the east storm drain system headwall. Erosion debris (soil and stone) had been transported from the eroded area to the discharge side of the headwall and adjacent areas. Continued erosion created the potential for a transversable pathway under the security fencing as well as loss of stability of the local ground area.

Along the east bank of the Diversion Stream, additional erosion had occurred at the east tributary stream inflow which drains the wooded wetland area to the east of the Diversion Stream's engineered channel.

The above erosion issues were corrected via implementation of an engineering change package.

Conclusion

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program has been demonstrated to be capable of managing aging effects of the water-control structures. The program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.42 SELECTIVE LEACHING PROGRAM

Program Description

The Selective Leaching Program is a new program that will demonstrate the absence of selective leaching. The program for selective leaching of materials will ensure the integrity of the components made of ductile iron, gray cast iron and copper alloys (except for inhibited brass) that contain greater than 15 percent zinc (> 15% Zn) exposed to a water environment (e.g., raw water, treated water, soil, etc.) that may lead to selective leaching of one of the metal components where there has not been previous experience of selective leaching. There are no aluminum bronze in-scope components with greater than eight percent aluminum.

The program is a one-time visual inspection coupled with either hardness measurement or other mechanical examination techniques such as destructive testing (when the opportunity arises), scraping, or chipping of selected components that may be susceptible to selective leaching. Follow-up of unacceptable inspection findings will include an evaluation using the corrective action program and a possible expansion of the inspection sample size and location.

Inspections will include a representative sample of the system population and will focus on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. A representative sample size will be 20% of the population (defined as components having the same material and environment combination) with a maximum of 25 components. Otherwise, a technical justification of the methodology and sample size used for selecting components for one-time inspection will be included as part of the program's documentation.

Those ductile iron and gray cast iron buried components which (a) have been cathodically protected since installation, (b) the cathodic protection system has had 80 percent availability for the last 10 year period prior to the period of extended operation, and (c) the as-found pipe-to-soil potential readings during periodic cathodic protection surveys meet the "acceptance criteria" program element of AMP XI.M41 do not require selective leaching inspections.

Underground components which have their external surfaces coated in accordance with Table XI.41-1 of AMP XI.M41, and where visual examinations of in-scope buried piping has not revealed any coating damage, do not require selective leaching inspections. A single instance of through-wall coating damage to underground cast iron pipe with confirmed evidence of leaching (not in-scope piping) has occurred at PNPP. Because the operating experience is a single instance, the inspection sample size for coated underground cast iron pipe may be reduced to 5 percent of the population with a maximum of six components.

The acceptance criteria will consist of no visible evidence of selective leaching or no more than a 20 percent decrease in hardness. For copper alloys with greater than 15 percent zinc, the criteria will be no noticeable change in color from the normal yellow color to the reddish copper color.

The Selective Leaching Program one-time visual inspection will be conducted within 5 years of, and no later than six months prior to, the period of extended operation.

NUREG-1801 Consistency

The Selective Leaching Program is a new program for PNPP that will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M33 *Selective Leaching* and revised by LR-ISG-2011-03 and LR-ISG-2015-01, with one exception.

Exceptions to NUREG-1801

Materials exposed to contaminated fuel oil and water-contaminated lube oil are managed under the XI.M39, *Lubricating Oil Analysis* and XI.M30, *Fuel Oil Chemistry* programs. **Program Element Affected: Scope (Element 1)**

Justification for exception

The XI.M39, *Lubricating Oil Analysis* and XI.M30, *Fuel Oil Chemistry* programs assure the exclusion of water such that materials susceptible to selective leaching are not exposed to water contamination.

Enhancements

None

Operating Experience

The following operating experience review provides objective evidence that the Selective Leaching Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

An extensive review of Operating Experience since 2013 is documented. The review did not identify any instances of loss of material due to selective leaching, graphitization, dezincification or de-alloying for any in-scope components.

A single instance of through-wall coating damage to underground cast iron pipe with confirmed evidence of leaching (not in-scope piping) has occurred at PNPP.

The NUREG-2191 XI.M33, *Selective Leaching* program, indicates industry operating experience shows that selective leaching has been detected in components constructed from gray cast iron, ductile iron, brass, bronze, and aluminum bronze.

Conclusion

The Selective Leaching Program will provide reasonable assurance that aging effects will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.43 STRUCTURES MONITORING PROGRAM

Program Description

The Structures Monitoring Program is an existing condition monitoring program that manages the effects of aging on structures and structural components within the scope of license renewal. The program was developed to implement the requirements of 10 CFR 50.65 and is based on guidance in Regulatory Guide 1.160 Revision 2, *Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*, and NUMARC 93-01 Revision 2, *Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.*

The scope of the Structures Monitoring Program includes structures, structural components, component supports, and structural commodities in the scope of license renewal that are not addressed by other structural aging management programs (AMPs) (i.e., ASME Section XI, Subsection IWE (AMP XI.S1); ASME Section XI, Subsection IWL (AMP XI.S2); ASME Section XI, Subsection IWF (AMP XI.S3); and *RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants* (AMP XI.S7)). The scope of Structures Monitoring Program also includes the in scope (non-safety/non-seismic) masonry walls as described in AMP XI.S5.

Aging effects associated with the in-scope masonry walls are managed by the structures monitoring program as described in the Masonry Walls Aging Management Program Description. There are no safety related masonry walls that are in close proximity to or having attachments from safety-related systems or components, as such PNPP does not have any safety related masonry walls meeting the criteria of I.E Bulletin 80-11 or IN 87-67. The masonry walls that are within the scope of license renewal at PNPP are limited to isolated non-safety related, non-seismic Category I structures. The scope of the structures monitoring program also includes managing aging effects associated with the plant underdrain system, storm drains that are considered as bulk commodities and porous concrete sub-foundations.

The program consists of periodic inspection, monitoring and trending of the conditions of structures and structural components to ensure that aging degradation leading to loss of intended functions will be detected and that the extent of degradation can be determined. Unacceptable conditions, when found, are evaluated or corrected in accordance with the corrective action program. Change in material properties for concrete, concrete blocks, elastomers, lubrite/sliding plates, porous concrete and unimpregnated and impregnated (with elastomer) fiber glass fabric are included in the monitored aging effects. Concrete structures are inspected for indications of deterioration and distress. Elastomers will be monitored for hardening, shrinkage and loss of sealing. Rock/stone embankment structures will be inspected for loss of material and loss of form. Component supports will be inspected for loss of material and reduction in anchor capacity due to local concrete degradation. Exposed surfaces of bolting are monitored for loss of material and loose or missing nuts and bolts.

The program also includes provisions for periodic testing and assessment of ground water chemistry and inspection of accessible below grade concrete structures. A de-watering system is not relied upon to control building settlement.

Protective coatings are not relied upon to manage the effects of aging for structures included in the scope of this program.

NUREG-1801 Consistency

The Structures Monitoring Program is an existing PNPP program that after enhancements, will be consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.S6, *Structures Monitoring*.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented in the identified program elements no later than six months prior to the period of extended operation.

Scope (Element 1)

- The program implementing procedure will be enhanced to include a listing of Unit 1 and Unit 2 structures and structural bulk commodities within the scope of license renewal that credit the Structures Monitoring Program for aging management.
- The program implementing procedure will list the current procedures/instructions that combine to manage the aging effects of the structural elements that are within the scope of the structures monitoring program as part of aging management for license renewal.
- The program will be enhanced to monitor the structural integrity of the plant underdrain system including the porous concrete sub-foundations.
- The program will be enhanced to monitor ground water chemistry including accounting for seasonal variations.
- The program will be enhanced to monitor the loss of material and flow blockage in the plant storm drain piping.
- The program will be enhanced to inspect the in-scope non-safety related/non-seismic masonry walls for loss of material (spalling, scaling), change in material properties and cracking due to freeze-thaw.

Preventive Actions (Element 2):

- The program will be enhanced to include preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting (actual measured yield strength greater than or equal to 150 ksi).
- The program will be enhanced to include preventive actions for storage of high strength bolting (actual measured yield strength greater than or equal to 150 ksi) from

Section 2 of Research Council for Structural Connections publication, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.

Parameters Monitored/Inspected (Element 3) and Detection of Aging Effects (Element 4)

- The program will be enhanced to take credit for the existing monitoring program elements in place to maintain the structural integrity of the plant underdrain system including the porous concrete sub-foundations. The program elements would include:
    - the plant underdrain system maintenance and inspection
    - monitoring for building settlement,
    - monitoring the groundwater elevation.
- The program will be enhanced to monitor ground water chemistry on a frequency of at least once every five years for pH, chlorides, and sulfates and verify that it remains non-aggressive, or evaluate results exceeding criteria to assess impact, if any, on below-grade concrete.
- The program will be enhanced to require that structures and structural components are monitored on a frequency not to exceed 5 years.
- The program will be enhanced to specify that a representative sample of high strength (actual measured yield strength ≥ 150 ksi or 1,034 MPa) structural bolts greater than 1 inch (25 mm) in diameter are monitored for stress corrosion cracking (SCC) at least once every 10 years.
- The program will be enhanced to monitor accessible sliding surfaces to detect significant loss of material due to wear, corrosion, debris, dirt, distortion, or overload that could restrict or prevent sliding of surfaces as required by design.
- The program will be enhanced to require inspection of elastomeric components for cracking, loss of material and hardening. Visual inspections of elastomeric components are to be supplemented by feel or manipulation to detect hardening. Include instructions to enhance the visual examination of elastomeric material with physical manipulation of at least ten percent of available surface area.
- The program will be enhanced to require (a) evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas and (b) examination of representative samples of the exposed portions of the below grade concrete, when excavated for any reason. If normally inaccessible areas become accessible due to planned activities, an inspection of these areas shall be conducted.
- The program will be enhanced to require the plant storm drain piping be monitored for:
    - Unacceptable flow blockage
    - Observed structural degradation

  This monitoring will consist of direct observation (storm drain grating flow and blockage) and periodic remote visual inspections of sampled portions of storm drain system piping. Additionally, the site's implementing document will include required inspections following offsite agency confirmation that an earthquake has occurred in the area of the plant for any sign of ground settlement that could be an indication of storm drain piping collapse to assure the integrity of the piping.

- Perform special inspections of the storm drain system immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls.

Acceptance Criteria (Element 6)

- Plant procedures will be updated to prescribe quantitative acceptance criteria based on the acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11 and relevant AISC specifications. Industry and plant specific operating experience will also be considered in the development of the acceptance criteria.
- Loose bolts and nuts and cracked high strength bolts will not be acceptable unless accepted by engineering evaluation.
- Structural sealants will be acceptable if the observed loss of material, cracking, and hardening will not result is loss of sealing.
- Elastomeric vibration isolation elements will be acceptable if there is no loss of material, cracking, or hardening that could lead to the reduction or loss of isolation function.
- Acceptance criteria for sliding surfaces will be (a) no indications of excessive loss of material due to corrosion or wear and (b) no debris or dirt that could restrict or prevent sliding of the surfaces as required by design.
- Acceptance criteria for high strength structural bolting shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section V, Article 5, Appendix IV.
- The program will be enhanced to require that personnel performing inspections and evaluations meet the qualifications specified within ACI Report 349.3R with respect to knowledge of inservice inspection of concrete and visual acuity requirements.
- Unimpregnated and impregnated (with elastomer) fiber glass fabric will be monitored for cracking, delaminating and visible deterioration.

Operating Experience

The following operating experience examples provide objective evidence that the Structures Monitoring Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

In March 1997, the U.S. Nuclear Regulatory Commission (NRC) issued information notice IN 97-11, to alert addressees to information regarding the possible erosion of cement from porous concrete sub-foundations below the reactor building basemats at some reactor sites. It was expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to monitor similar phenomena at their plants. PNPP was one of the plants identified in this information notice. The issue of the loss of calcium from the porous concrete and the precipitation of calcium carbonate in the porous concrete, porous concrete pipe, and underdrain manholes had been a subject of investigation since 1983 at PNPP. Engineering evaluations performed concluded that the interior of the porous concrete layer (under the plant buildings) is fairly stagnant and leaching of calcium is localized in the peripheral portions of the porous concrete pad, and not uniformly throughout the pad.

Additionally, building settlement data are collected on a quarterly basis by measuring the elevation of a number of “permanent settlement markers” installed in the exterior of plant structures. The details of the settlement are reviewed by Design Engineering. There has been no significant building settlement that has been identified that would indicate that the underdrain basemat is degraded and not performing its function. Various preventative maintenance procedures/instructions are in place to ensure that the plant underdrain system is performing its design function.

In November 2005, cracks and chipped areas of concrete were identified on the concrete pedestal of the Division I Diesel Generator below the engine. These cracks were considered hairline cracks, which are normal in concrete structures and were/are considered acceptable. These cracks are being monitored as part of maintenance rule walk downs to ensure they will not degrade to an unacceptable level which could impact the structural integrity of the concrete structure.

In August 2012, the maintenance rule walkdown for the Intermediate Building noted several deficiencies that were acceptable for the current inspection cycle. The acceptable deficiencies were evaluated and assigned corrective actions as necessary to ensure they would not lead to unacceptable deficiencies. Examples of corrective actions included, repair/replacement of conduit, rework/repair of leaking roof, and rework/repair of conduit supports.

In May 2012, the maintenance rule walk down for the Auxiliary Building noted several deficiencies that were acceptable for the current inspection cycle. The acceptable deficiencies were evaluated and assigned corrective actions as necessary to ensure they would not lead to unacceptable deficiencies. Examples of corrective actions included restore pipe insulation, recoat piping as needed, rework/restore floor coating, rework cover holding mounting bolts and clean the roof/remove debris.

In May 2012, the maintenance rule walk down for the Fuel Handling Building noted several deficiencies that were acceptable for the current inspection cycle. The acceptable deficiencies were evaluated and assigned corrective actions as necessary to ensure they would not lead to unacceptable deficiencies. Results of the Fuel Handling Building Maintenance Rule walk down identified three items with a potential Fire Protection significance.

1. A tear/crack in the penetration sealant material of the seismic gap between the Shield Building and the Intermediate Building wall near Door IB-209
2. A tear/crack in the penetration sealant material of the seismic gap between the Shield Building and the Intermediate Building wall near Door IB-217
3. An approximately 3/16" gap in sealant material at a floor penetration on the 599' elevation located near the building coordinate of IB-8 and IB-G.

Both Items 1 and 2 above are located in Fire Zone IB-2. Per the PNPP Fire Protection Evaluation Report, sections 9A.4.3.1.1 and 9A.4.3.2.1, the Reactor Building interfaces are unprotected openings. Unprotected openings do not have a fire rating and therefore there cannot be any degradation of a fire barrier as a result of the condition described in items 1 and 2. Item 3 documents a potential degradation of a fire barrier since the condition was noted around a floor penetration located within Fire Zone FH-2a. Floor penetrations in this Fire Zone have a three-hour barrier rating per Section 9A.4.7.2.1. However, the condition was determined to be insufficiently deep (depth of only an inch or two and not fully penetrating) to challenge the integrity of the fire barrier. The acceptable deficiencies were assigned corrective actions as necessary to ensure they would not lead to unacceptable deficiencies.

Industry Operating Experience concerning laminar cracking of concrete structure subsurfaces is documented in NRC Information Notice 2013-04, *Shield Building Concrete Subsurface Laminar Cracking Caused by Moisture Intrusion and Freezing* dated March 7, 2013. The review of this condition relative to PNPP has determined the following.

- As no protective sealant has been applied to the exterior of the PNPP shield building, the structure is susceptible to the expansive forces in the presence of high internal moisture content. The event report identifies the potential for laminar cracking to initiate and propagate in areas of closely spaced rebar (6 inches center-to-center). As the architecture of the shield building in this area is unlikely to produce the initial laminar cracking, propagation of cracking is not expected. In the event that laminar cracking did initiate in this area and then propagated through this area, the crack length would be limited based on the relatively short section of closely spaced rebar.
- The shield building does not contain architectural flutes and the majority of the shield building rebar has been shown as sufficient to preclude laminar cracking and crack propagation. Therefore, the conditions susceptible to laminar cracking are minimal over the majority of the structure. As such, no actions are required at PNPP to further prevent laminar cracking due to extreme weather conditions.

From 2013 through to date, various condition reports were written to document roof leaks in various plant buildings. Corrective actions included either repair of roofs, roof replacements or in planning for planned future repairs. Additionally, the plant procedure "Monitoring the Effectiveness of Maintenance Structure Monitoring Program" includes periodic inspections of plant buildings which identify any such deficiencies and corrective actions taken accordingly.

The above examples of site operating experience provide evidence that as a result of implementation of the structures monitoring program, conditions continue to be documented, trended, and evaluated. As needed, corrective actions are initiated, tracked and implemented. Any operability concerns are promptly identified and addressed and evaluated.

Conclusion

The Structures Monitoring Program, with enhancement, will provide reasonable assurance that aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.44 WATER CHEMISTRY PROGRAM

Program Description

The Water Chemistry Program is an existing prevention and mitigation program whose activities mitigate the loss of material due to corrosion, cracking due to stress corrosion cracking (SCC) and reduction of heat transfer in components exposed to a treated water environment. The program includes periodic monitoring and control of water chemistry to keep peak levels of various contaminants below the system-specific limits based on Electric Power Research Institute (EPRI) guideline BWRVIP-190, (EPRI 3002002623), BWR Water Chemistry Guideline, Revision 1, 2019 Interim Guidance for BWRs.

The One-Time Inspection Program will be used to verify the effectiveness of the Water Chemistry Program.

The program will be continued for the period of extended operation.

NUREG-1801 Consistency

The Water Chemistry Program is an existing PNPP program that is consistent with the 10 elements of an effective aging management program as described in NUREG-1801, Section XI.M2, *Water Chemistry*, with one exception.

Exceptions to NUREG-1801

The water chemistry program for boiling water reactors relies on monitoring and control of reactor water chemistry based on industry guidelines contained in the Boiling Water Reactor Vessel and Internals Project (BWRVIP)-190 (Electric Power Research Institute [EPRI] 1016579) 2008 revision. PNPP's water chemistry program is based on compliance with BWRVIP-190, *BWR Water Chemistry Guideline, Revision 1, 2019 Interim Guidance* (EPRI 3002002623)**. Program Element Affected: Scope of Program (Element 1)**

Justification for Exception:

In February 2021, the NRC issued SLR-ISG-2021-02-MECHANICAL *Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance - Interim Staff Guidance.* In this document, the Staff recognizes BWRVIP-190, *BWR Water Chemistry Guideline, Revision 1* as acceptable to cite. (See the following excerpt.)

> *"EPRI has issued BWRVIP-190, "BWR Water Chemistry Guidelines - Mandatory, Needed, and Good Practice Guidance." Revision 1. Consistent with the staff's evaluation of an exception documented in NUREG–2205, "Safety Evaluation Report Related to the License Renewal of LaSalle County Station, Units 1 and 2," September 2016, Section 3.0.3.2.1, "Water Chemistry," the staff finds the use of BWRVIP-190, Revision 1, "BWR Vessel and Internals Project, Volume 1, BWR Water Chemistry Guidelines – Mandatory, Needed, and Good Practice Guidance," EPRI 3002002623, dated April 24, 2014, acceptable to cite."* (SLR-ISG-2021-02-MECHANICAL, *Updated Aging Management Criteria for Mechanical Portions of Subsequent License Renewal Guidance -Interim Staff Guidance.)*

In all instances, the chemistry parameter guidelines for Action Levels in BWRVIP-190, Revision 1, 2019 Interim Guidance, are the same or more restrictive as BWRVIP-190, Revision 1. Therefore, the PNPP Water Chemistry Aging Management Program, as defined by BWRVIP-190, Revision 1, 2019 Interim Guidance, will continue to be effective in mitigating the loss of material due to corrosion, cracking due to stress corrosion cracking and related mechanisms, and reduction of heat transfer due to fouling in components exposed to a treated water environment.

Enhancements

None

Operating Experience

The following operating experience examples provide objective evidence that the Water Chemistry Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

The condition reports cited are a small representative sample of Operating Experience documented by the corrective action program. The condition reports are addressed below.

In October 2014, a condition report documented and tracked elevated Reactor Water Chloride and Sulfate concentrations during a period in which the Reactor Water Cleanup (RWCU) system was removed from service for required repairs. The excursion was anticipated, and the period during which the out-of-specification condition was documented, evaluated and appropriately reported. The Chemistry Unit worked with Operations and Maintenance to ensure RWCU repairs were accomplished such that Reactor Water Chemistry would remain within specifications once completed.

In October 2015, a Condition Report was written by Chemistry Unit personnel identifying increases in reactor vessel sulfate and chloride concentrations, as well as specific conductivity. Investigation revealed a faulty controller that allowed a condensate demineralizer bypass valve to open. This condition allowed an untreated portion of the condensate demineralizer system effluent to enter the reactor vessel resulting in the increase in reactor water impurities. Plant Operations acted to manually stop the bypass flow until the controller was repaired, and reactor chemistry returned to normal. The actions demonstrate prompt response to an out-of-specification condition and expeditious correction in accordance with Chemistry program requirements.

In September 2015, a condition report was written with the onset of minor condenser inleakage. The inleakage, although small, was quantified using flow rates and impurity concentrations. Troubleshooting and repair ensued that stopped the inleakage and ensured reactor chemistry remained within specifications. Adherence to the Chemistry Unit's monitoring program corrected the inleakage before it affected the reactor chemistry.

In July 2015, a condition report was written when daily program surveillance reported unacceptable flow variability through the zinc injection system. The Chemistry Unit responded with more frequent monitoring and manual adjustments as required. The discovery and response demonstrate appropriate monitoring and follow-up to ensure vital equipment operation within required parameters.

In February 2016, a condition report identified that a Hydrogen Water Chemistry (HWC) performance indicator was unacceptable for January and February. The HWC system was unavailable for 31.6 hours in January during the time the reactor was greater than 200 degrees F due to shutdown and startup from the January maintenance outage. This resulted in the monthly HWC availability performance indicator for January to fall below the bottom quartile threshold of 95.9% .

The HWC system was unavailable for 25.3 hours in February during the time the reactor was greater than 200 degrees F due to startup from the January maintenance outage and shutdown/startup from the February forced outage. Additionally, a HWC system trip occurred when shifting from the motor feed pump to the reactor feed pump during startup. This resulted in the monthly HWC availability performance indicator in February to remain below the bottom quartile threshold of 95.9%.

Hydrogen injection reduces the potential for crack initiation in reactor vessel internals. HWC availability is one of the criteria for Inspection relief per BWRVIP-245, Implementation Guide for Inspection Relief for Boiling Water Reactors with Hydrogen Injection. The goal for Inspection Relief is 95% HWC availability for the cycle. Loss of availability during the month erodes margin for achieving the inspection relief goal as well as achieving the industry goal of 98% availability. The monitoring of system status and tracking out-of-service time demonstrates compliance with plant program tracking trending and monitoring requirements and BWRVIP-190.

In January 2017, routine daily sample revealed that reactor water sulfate was elevated to 1.5 ppb. This result was confirmed with a second sample. (Normal sulfate concentration is < 0.5 ppb.) Although this sulfate concentration did not have an impact on the Chemistry Effectiveness Indicator (CEI), with increase in the sulfate concentration, the Chemistry Unit responded in accordance with program requirements, promptly identified the source of impurity ingress as resin bleed-through from the reactor water cleanup system and worked with operations to correct it before significant impact.

In July 2018, during injection of 1N22F0010 (Extraction Steam to 1st Stage Reheater ‘B’ Drain valve) to stop a steam leak, a Feedwater conductivity excursion was experienced. Feedwater conductivity reached a peak value of 0.084 umho/cm which exceeded the administrative limit of 0.065 umho/cm. Elevated conductivities were also noted in Rx Recirc (0.15 umho/cm), RWCU Influent, and RWCU B effluent due to this injection, although no limits were exceeded in these systems. The anticipated excursion was promptly identified, and its source identified from previous experience. Required actions for a parameter exceeding a BWRVIP Action Level 1 were evaluated. The parameter returned to baseline values in less than one hour, no additional sampling or actions were necessary. Compliance with Fuel Warranty conditions regarding continuous limits were evaluated – Feedwater conductivity did not exceed continuous or cumulative out-of-limit hours allowed by the Fuel Warranty. No further action was necessary. The actions taken, monitoring and documentation were directed by and in compliance with program procedures and policies.

In July 2019, a condition report was initiated following a reactor trip and Hotwell dissolved oxygen increase to 2700 ppb. The Control Room was notified, and operations personnel closed a loop seal drain valve. Chemistry personnel adjusted the oxygen injection flow control valve and increased the monitoring frequency. Following prompt identification from program-directed monitoring, the cause was identified, and actions taken with Hotwell chemistry returning to its normal band.

In June 2020, low-level trends in reactor water indicated that there was a small feed of impurities to the reactor, most likely from a condensate demineralizer nearing exhaustion. A troubleshooting plan was established. The source of the impurity ingress was isolated to a single condensate demineralizer effluent. The demineralizer was removed from service and a fresh demineralizer was placed into service. Reactor chemistry returned to its normal band. Program-directed monitoring led to the discovery of a minor ingress that was eliminated with effective actions.

In April 2021, a condition report was initiated to document elevated chloride and sulfate concentrations above CEI threshold during start-up from refuel. The condition was anticipated because of the unavailability of one of the two Reactor Water Cleanup pumps, and program actions were in place to safely manage the excursion until chemistry parameters returned to normal control bands.

Hydrogen water chemistry (HWC) has been shown to be an effective method of mitigating intergranular stress corrosion cracking (IGSCC) by reducing corrosion potential, though it has demonstrated side effects of increasing radiation dose fields in the plant due to N-16. Noble Metal Chemical Addition (NMCA) was developed to achieve mitigation of IGSCC without experiencing the undesirable effects that occur when using only HWC. The Water Chemistry Program at PNPP utilizes HWC, OLNC (the current process that replaced NMCA), and maintaining chloride and sulfate levels in reactor coolant as low as possible to achieve mitigation of IGSCC.

PNPP has chosen to maintain noble metal levels in the reactor vessel and associated piping using the On-Line Noble Metals Application (OLNC) methodology. OLNC applications have been performed annually since 2008. In-vessel sampling has indicated consistent noble metal deposition ranging from 0.75 $\mu g/cm^2$ to 1.1 $\mu gm/cm^2$ over Cycle 13 through Cycle 18. This verifies actual noble metal deposition on internal vessel surfaces significantly exceeds the deposition required for mitigation.

Conclusion

The Water Chemistry Program has been effective at managing aging effects. The program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

C.0 BWRVIP Applicant Action Items

C.1 Response to BWRVIP Applicant Action Items

Of the BWRVIP documents credited for PNPP license renewal, the following have NRC safety evaluation reports for license renewal.

BWRVIP-18	*BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines*, Revision 2
BWRVIP-25	*BWR Core Plate Inspection and Flaw Evaluation Guidelines, Revision 1*
BWRVIP-26-A	*BWR Top Guide Inspection and Flaw Evaluation Guidelines*
BWRVIP-27-A	*BWR Standby Liquid Control System / Core Plate ΔP Inspection and Flaw Evaluation Guidelines*
BWRVIP-38	*BWR Shroud Support Inspection and Flaw Evaluation Guidelines*
BWRVIP-41	*BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines*, Revision 4
BWRVIP-42	*LPCI Coupling Inspection and Flaw Evaluation Guidelines*, Revision 1
BWRVIP-47-A	*BWR Lower Plenum Inspection and Flaw Evaluation Guidelines*
BWRVIP-48	*Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines, Revision 1*
BWRVIP-49-A	*Instrument Penetration Inspection and Flaw Evaluation Guidelines*
BWRVIP-74-A	*BWR Vessel and Internals Project BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal*
BWRVIP-76	*BWR Core Shroud Inspection and Flaw Evaluation Guidelines Core Shroud Basis,* Revision 1
BWRVIP-138 R-1A	*Updated Jet Pump Beam Inspection and Flaw Evaluation*
BWRVIP-139 R1-A	*BWR Vessel and Internals Project Steam Dryer Inspection and Flaw Evaluation Guidelines*

License renewal applicant action items identified in the corresponding safety evaluation report for each of the above reports are addressed in the following table. BWRVIP documents without safety evaluation reports for license renewal have no applicant action items and are therefore not included in the table.

It is recognized that the first three action items from each of the license renewal SERs applicable to the above BWRVIP reports are fundamentally identical, with the exception of BWRVIP-138, R-1A and BWRVIP-139-R1-A. For that reason, they are combined in the table and addressed together. For safety evaluation reports that contain additional applicant action items, the response is provided separately following the responses to the three common action items.

Action Item Description	PNPP Response
Common Action Items from BWRVIP-18 Rev. 2, -25 Rev. 1, -26-A, -27-A, -38, -41 Rev 4, -42 Rev. 1, -47-A, -48 Rev. 1, -49-A, -74-A, and -76 Rev. 1	
BWRVIP-All (1) The license renewal applicant is to verify that its plant is bounded by the report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within these BWRVIP reports described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP reports have been reviewed and PNPP has been verified to be bounded by the reports. In addition, PNPP commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B. Deviation from a BWRVIP report approved by the NRC is reported to the NRC per BWRVIP-94. In accordance with the requirements of 10 CFR 54.21(a)(3), an aging management review (AMR) was conducted for the reactor vessel internals. AMR results are provided in LRA Table 3.1.2-6. In accordance with the requirements of 10 CFR 54.21I(1), TLAAs identified for reactor vessel internals have been evaluated for PNPP. See LRA Sections 4.3.4 and 4.7.3.
BWRVIP-All (2) 10 CFR 54.21(d) requires that an UFSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs for the period of extended operation. Those applicants for license renewal referencing the applicable BWRVIP report shall ensure that the programs and activities specified as necessary in the applicable BWRVIP reports are summarily described in the UFSAR supplement.	The UFSAR supplement is included as Appendix A and includes a summary of the programs and activities specified as necessary for the BWRVIP program.

Action Item Description	PNPP Response
BWRVIP-All (3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. The applicable BWRVIP reports may state that there are no generic changes or additions to technical specifications associated with the report as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the applicable BWRVIP report shall ensure that the inspection strategy described in the reports does not conflict with or result in any changes to their technical specifications. If technical specification changes or additions do result, then the applicant must ensure that those changes are included in its application for license renewal.	There are no changes to technical specifications that are required to meet the requirements of the BWRVIP reports during the period of extended operations. However, Technical Specification 3.4.11 will be revised separate from the license renewal process in accordance with 10 CFR 50.90 [Reference BWRVIP-74-A response].
Additional Action Items	
BWRVIP-18 Rev. 2, *Core Spray Internals Inspection and Flaw Evaluation Guidelines*	
BWRVIP-18 Rev. 2 (4) Applicants referencing the BWRVIP-18 report for license renewal should identify and evaluate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components.	TLAAs identified for reactor vessel internals have been evaluated for PNPP in LRA Sections 4.3.4 and 4.7.3.
BWRVIP-25 Rev. 1, *Core Plate Inspection and Flaw Evaluation Guidelines*	
BWRVIP-25 (4) Due to susceptibility of the rim hold-down bolts to stress relaxation, applicants referencing the BWRVIP-25 report for license renewal should identify and evaluate the projected stress relaxation as a potential TLAA issue.	BWRVIP-25 concluded that preload of the rim hold-down bolts is required to prevent lateral motion of the core plate for those plants that have not installed core plate wedges. Since PNPP is a BWR/6 with core plate wedges, the preload on the core plate bolts is not required. Therefore, there is no associated TLAA for PNPP.

Action Item Description	PNPP Response
BWRVIP-25 (5) Until such time as an expanded technical basis for not inspecting the rim hold-down bolts is approved by the staff, applicants referencing the BWRVIP-25 report for license renewal should continue to perform inspections of the rim hold-down bolts.	Under the guidance and recommendations of BWRVIP-25, no core plate or rim hold-down bolt inspections are recommended for BWR/6 reactors such as PNPP.
BWRVIP-26-A, ***Top Guide Inspection and Flaw Evaluation Guidelines***	
BWRVIP-26-A (4) Due to IASCC susceptibility of the subject safety-related components, applicants referencing the BWRVIP-26 report for license renewal should identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue.	TLAAs identified for reactor vessel internals have been evaluated for PNPP in LRA Sections 4.3.4 and 4.7.3.
BWRVIP-27-A, ***Standby Liquid Control System / Core Plate ΔP Internals Inspection and Flaw Evaluation Guidelines***	
BWRVIP-27-A (4) Due to the susceptibility of the subject components to fatigue, applicants referencing the BWRVIP-27 report for license renewal should identify and evaluate the projected fatigue cumulative usage factors as a potential TLAA issue.	Fatigue TLAA for reactor vessel internals is evaluated in LRA Section 4.3.4 and 4.7.3.
BWRVIP-42, Rev. 1 ***LPCI Coupling Inspection and Flaw Evaluation Guidelines***	
BWRVIP-42, Rev. 1 (4) Applicants referencing the BWRVIP-42 report for license renewal should identify and evaluate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components.	Reactor vessel internals fatigue TLAAs are evaluated in LRA Section 4.3.4 and 4.7.3.

Action Item Description	**PNPP Response**
BWRVIP-42, Rev. 1 (5) The BWRVIP committed to address development of the technology to inspect inaccessible welds and to have the individual LR applicant notify the NRC of actions planned. Applicants referencing the BWRVIP-42 report for license renewal should identify this action as open and to be addressed once the BWR'IP's response to this issue has been reviewed and accepted by the staff.	As provided in BWRVIP-94NP, each utility is committed to NEI 03-08 and shall implement appropriate BWRVIP guidelines and recommendations. Until an inspection technique becomes available from the BWRVIP, PNPP will continue to evaluate the inaccessible welds according to the guidelines in Section 3.9 of BWRVIP-42, Revision 1.
BWRVIP-47-A, ***BWR Lower Plenum Inspection and Flaw Evaluation Guidelines***	
BWRVIP-47-A (4) Due to fatigue of the subject safety-related components, applicants referencing the BWRVIP-47 report for LR should identify and evaluate the projected CUF as a potential TLAA issue.	Reactor vessel internals fatigue TLAAs are evaluated in LRA Section 4.3.4 and 4.7.3.
BWRVIP-74-A, ***BWR Vessel and Internals Project BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal***	
BWRVIP-74-A (4) The staff is concerned that leakage around the reactor vessel seal rings could accumulate in the VFLD lines, cause an increase in the concentration of contaminants and cause cracking in the VFLD line. The BWRVIP-74 report does not identify this component as within the scope of the report. However, since the VFLD line is attached to the RPV and provides a pressure boundary function, LR applicants should identify an AMP for the VFLD line.	The vessel flange leak detection (VFLD) line is within the scope of license renewal and subject to aging management review. Loss of material and cracking are identified as aging effects requiring management. Aging of the vessel flange leak detection line is managed by the Water Chemistry Control – BWR Program as verified by the One-Time Inspection Program

Action Item Description	**PNPP Response**
BWRVIP-74-A (5) LR applicants shall describe how each plant-specific aging management program addresses the following elements: (1) scope of the program, (2) preventive actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	There are no plant-specific aging management programs credited for managing aging of reactor pressure vessel components. Descriptions of the aging management programs credited for managing the reactor pressure vessel are described in LRA Appendix B. These descriptions include any program element that deviates from the NUREG-1801 program element, and any enhancements that are needed to be consistent with NUREG-1801 requirements.
BWRVIP-74-A (6) The staff believes inspection by itself is not sufficient to manage cracking. Cracking can be managed by a program that includes inspection and water chemistry. BWRVIP-29 describes a water chemistry program that contains monitoring and control guidelines for BWR water that is acceptable to the staff, BWRVIP-29 is not discussed in the BWRVIP-74 report. Therefore, in addition to the previously discussed BWRVIP reports, LR applications shall contain water chemistry programs based on monitoring and control guidelines for reactor water chemistry that are contained in BWRVIP-29.	The PNPP Water Chemistry Program consistency with NUREG-1801, Revision 2,-XI.M2, "Water Chemistry" is discussed in LRA Appendix B.
BWRVIP-74-A (7) LR applicants shall identify their vessel surveillance program, which is either an ISP or plant-specific invessel surveillance program, applicable to the LR term.	PNPP Reactor Vessel Surveillance Program is discussed in LRA Appendix B.

Action Item Description	PNPP Response
BWRVIP-74-A (8) LR applicants should verify that the number of cycles assumed in the original fatigue design is conservative to assure that the estimated fatigue usage for 60 years of plant operation is not underestimated. The use of alternative actions for cases where the estimated fatigue usage is projected to exceed 1.0 will require case-by-case staff review and approval. Further, a LR applicant must address environmental fatigue for the components listed in the BVVRVIP-74 report for the LR period.	The reactor vessel fatigue TLAAs, including the projected cycles for the period of extended operation are evaluated in LRA Section 4.3.1. Environmental fatigue for reactor vessel components is evaluated in LRA Section 4.3.3.
BWRVIP-74-A (9) Appendix A to the BWRVIP-74 report indicates that a set of P-T curves should be developed for the heat up and cooldown operating conditions in the plant at a given EFPY in the LR period.	Development of pressure-temperature limits for the period of extended operation has been evaluated as a TLAA in LRA Section 4.2.3. The P-T curves in Technical Specification 3.4.11 will continue to be updated, as required by Appendix G of 10 CFR Part 50
BWRVIP-74-A (10) To demonstrate that the beltline materials meet the Charpy USE criteria specified in Appendix B of the report, the applicant shall demonstrate that the percent reduction in Charpy USE for their beltline materials are less than those specified for the limiting BWR/3-6 plates and the non-Linde 80 submerged arc welds and that the percent reduction in Charpy USE for their surveillance weld and plate are less than or equal to the values projected using the methodology in RG 1.99, Revision 2.	Percent reduction in Charpy upper shelf energy (USE) for beltline materials, plates, and welds for the period of extended operation is evaluated in LRA Section 4.2.2. The reductions have been shown to remain less than the limiting reductions discussed in BWRVIP-74-A.

Action Item Description	**PNPP Response**
BWRVIP-74-A (11) To obtain relief from the inservice inspection of the circumferential welds during the LR period, the BWRVIP report indicates each licensee will have to demonstrate that (1) at the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure frequency for circumferential welds in the Appendix E of the staffs July 28, 1998, FSER, and (2) that they have implemented operator training and established procedures that limit the frequency of cold overpressure events to the amount specified in the staffs FSER.	If any relief from the inservice inspection requirement for the circumferential welds is required during the period of extended operation, the conditions of the FSER will be met. As discussed in LRA Section 4.2.4, the failure probability assessment analyses for the circumferential welds have been projected to the end of the period of extended operation and satisfy the limiting conditional failure frequency.
BWRVIP-74-A (12) As indicated in the staff's March 7, 2000, letter to Carl Terry, a LR applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine the mean RTNDT of the limiting axial beltline weld at the end of the extended period of operation is less than the values specified in Table 1 of this FSER.	The RPV shell welds failure probability, including axial welds, has been evaluated in LRA Section 4.2.4
BWRVIP-74-A (13) The Charpy USE, P-T limit, circumferential weld, and axial weld RPV integrity evaluations are all dependent upon the neutron fluence. The applicant may perform neutron fluence calculations using a staff approved methodology or may submit the methodology for staff review. If the applicant performs the neutron fluence calculation using a methodology previously approved by the staff, the applicant should identify the NRC letter that approved the methodology.	An NRC approved methodology was used to determine fluence during the period of extended operation, as discussed in LRA Section 4.2.1

Action Item Description	PNPP Response
BWRVIP-74-A (14) Components that have indications that have been previously analytically evaluated in accordance with sub-section IWB-3600 of Section Xl to the ASME Code until the end of the 40-year service period shall be reevaluated for the 60-year service period corresponding to the LR term.	No ASME Section XI flawed components with evaluations in accordance with subsection IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period were identified for PNPP.
BWRVIP-76 Rev. 1, *BWR Core Shroud Inspection and Flaw Evaluation Guidelines*	
BWRVIP-76, Rev. 1 (4) The applicants shall reference the NRC staff approved TRs BWRVIP-14-A, BWRVIP-99 (when approved) and BWRVIP-100-A in their RVI component's' AMP. The applicants shall make a statement in their LRAs that the crack growth rate evaluations and fracture toughness values specified in these reports shall be used for cracked core shroud welds that are exposed to the neutron fluence values that are specified in these TRs. The applicants shall confirm that they will incorporate any emerging inspection guidelines developed by the BWRVIP for these welds.	The PNPP BWR Vessel Internals Program discussed in LRA Appendix B, Section B.2.14, references BWRVIP-14-A, BWRVIP-99-A and BWRVIP-100-A. Any emerging inspection guidelines developed by the BWRVIP for these welds are evaluated and incorporated into this program as applicable.
BWRVIP-76, Rev. 1 (5) LR applicants that have core shrouds with tie rod repairs shall make a statement in their AMPs associated with the RVI components that they have evaluated the implications of the Hatch Unit 1 tie rod repair cracking on their units and incorporated revised inspection guidelines, if any, developed by the BWRVIP.	PNPP does not have a core shroud with tie rod repairs.

Action Item Description	PNPP Response
BWRVIP-76, Rev. 1 (6) The NRC staff's guidance in Table IV.B1 of the GALL Report lists two potentially applicable aging effects (i.e., in addition to cracking) for generic BWR reactor vessel internal components (including BWR core shroud and core shroud repair assembly components) that are made from either stainless steel (including CASS) or nickel alloy: (1) loss of material due to pitting and crevice corrosion (Refer to GALL AMR IV.B1-15), and (2) cumulative fatigue damage (Refer to GALL AMR item IV.B1-14). BWR LR applicants will need to assess their designs to see if the generic guidelines for managing cumulative fatigue damage in GALL AMR item IV.B1-14 and for management loss of material due to pitting and crevice corrosion in GALL AMR IV.B1-15 are applicable to the design of their core shroud components (including welds) and any core shroud repair assembly components that have been installed through a design modification of the plant. If these aging effects are applicable to the design of these components as a result of exposing them to a reactor coolant with integrated neutron flux environment, applicants for license renewal will need to: (1) identify the aging effects as aging effects requiring management (AERM) for the core shrouds and for their core shroud repair assembly components if a repair design modification has been implemented, and (2) identify the specific aging management programs or time limited aging analyses that will be used to manage these aging effects during the period of extended operation. Refer to License Renewal Applicant Action Item 7) for additional guidance on identifying the AERMs for core shroud components or core shroud repair assembly components that made from materials other than stainless steel (including CASS) or nickel alloy.	The PNPP core shroud is fabricated from 304 stainless steel. The aging effects of loss of material, cracking and cumulative fatigue damage have been identified for the core shroud. Aging management results for the core shroud are provided in LRA Table 3.1.2-6. Shroud repair design modifications have not been implemented at PNPP. Fatigue of the reactor vessel internals for the period of extended operation is evaluated in LRA Section 4.3.4.

Action Item Description	PNPP Response
BWRVIP-76, Rev. 1 (7) For BWR LRAs identification of AERMs for core shroud components or core shroud repair assembly components that are made from materials other than stainless steel (including CASS), or nickel alloy will need to be addressed on a plant specific basis that is consistent with the Note format criteria for plant-specific AMR items in latest NRC-approved version TR NEI-95-10.	Not applicable to PNPP. The core shroud is fabricated from stainless steel and no repair hardware has been installed.
BWRVIP-76, Rev. 1 (8) LR applicants shall reference the NRC staff-approved topical reports BWRVIP-99 and BWRVIP-100-A in their RVI component's' AMP, as discussed in section 3.3 of this SER.	The PNPP BWR Vessel Internals Program discussed in LRA Section B.2.14, references BWRVIP-99-A and BWRVIP-100-A.
BWRVIP-138, R-1A, ***Updated Jet Pump Beam Inspection and Flaw Evaluation***	
As discussed in Section 3.2 of this SE, the staff requests that to take credit for an "effective" HWC environment and the longer re-inspection intervals described in the submittal, the plant operators must follow the guidance included in BWRVIP-62 and meet all of the conditions listed in the SE.	The PNPP Water Chemistry program is discussed in Appendix B, Section B.2.43. The jet pump beam inspections are performed as part of the PNPP BWR Vessel Internals program discussed in Appendix B, Section B.2.14.

Action Item Description	PNPP Response
BWRVIP-139-R1-A, *Steam Dryer Inspection and Flaw Evaluation Guidelines*	
BWRVIP-139-R1-A (1a) BWR applicants for license renewal are requested to perform a review of the CLB and design basis of their facilities to determine whether there are any design differences in their steam dryer designs or steam dryer-related OE that is applicable for their BWR design. Specifically, BWR applicants for license renewal are requested to perform a review of the CLB and design basis of their facilities to determine whether there are any additional aging effects/mechanisms that might be applicable to the designs of their BWR steam dryer assemblies, in addition to those that are mentioned as being applicable aging effects/mechanisms requiring management (AERMs) in BWRVIP-139-R1-A, Appendix B.	The aging effects/mechanisms for the steam dryer are discussed in LRA Sections 2.3.1.6 and 3.1.2. The steam dryer inspections are performed as part of the PNPP BWR Vessel Internals program discussed in Appendix B, Section B.2.14.
BWRVIP-139-R1-A (1b) For those BWR license renewal applicants that identify additional AERMs beyond those listed in BWRVIP-139-R1-A, Appendix B, the applicants should include applicable GALL-based or plant-specific AMR items in the LRAs that identify the additional aging effects that are applicable to their steam dryer designs, and should identify and justify the AMP or TLAA that will be used to manage those aging effects during the period of extended operation, as required by 10 CFR 54.21(a)(3)	No AERMs beyond those listed in the BWRVIP were identified.

Action Item Description	PNPP Response
BWRVIP-139-R1-A (2) Referencing of the BWRVIP-139-R1-A Report and Appendix B of the Report in the FSAR, UFSAR, or USAR Supplement For demonstration of the requirement in 10 CFR 54.21(d), BWR license renewal applicants applying the BWRVIP-139-R1-A report and Appendix B of the report to manage age-related degradation in their BWR steam dryer assemblies shall describe or reference in the applicable FSAR, UFSAR, or USAR supplement summary description for the AMP how the BWRVIP-139-R1-A report and Appendix B of the report will be used to manage aging in the plant's steam dryer assembly components during the period of extended operation.	The USAR supplement discussing the PNPP BWR Vessel Internals program is provided in Appendix A, Section A.1.14.

Action Item Description	PNPP Response
BWRVIP-139-R1-A (3) Identification of Time Limited Aging Analyses License renewal applicants are required by 10 CFR 54.21(c)(1) to identify all analyses in the CLB that conform to the six criteria in 10 CFR 54.3(a) for defining an analysis as a TLAA. For those BWR license renewal applicants that confirm that the CLB includes a steam dryer analysis, and the analysis conforms to the definition of TLAA, the applicants shall: a. include the TLAA in the LRA in accordance with the requirements in 10 CFR 54.21(c)(1) b. demonstrate that the TLAA will be acceptable for the period of extended operation in accordance with one of three criteria for accepting TLAAs in 10 CFR 54.21(c)(1)(i), (ii), or (iii), and c. include a FSAR, UFSAR or USAR supplement summary description for the TLAA in the LRA, in accordance with 10 CFR 54.21(d). These bases are consistent with the guidelines for formatting LRAs in NEI 95-10, Revision 6.	No TLAA related to the steam dryer was identified.

APPENDIX D

TECHNICAL SPECIFICATION CHANGES

10 CFR 54.22 requires that an application for license renewal include any Technical Specification changes or additions necessary to manage the effects of aging during the period of extended operation. A review of the information supporting this LRA and the PNPP Technical Specifications determined that no changes or additions to the Technical Specifications are required to manage the effects of aging during the PEO or to support the License Renewal Application. Therefore, this Appendix is not used.

Appendix E

Applicant's Environmental Report

License Renewal Stage

Perry Nuclear Power Plant Unit 1

May 2023

Table of Contents

List of Tables

List of Figures

List of Attachments

Abbreviations, Acronyms, and Symbols

§	Section
°C	degrees Celsius
°F	degrees Fahrenheit
AADT	average annual daily traffic
AC&H	Archaeological, Cultural and Historical
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
APE	area of potential effect
AQCR	air quality control region
ARERR	annual radiological effluent release report
ATWS	Anticipated Transient Without Scram
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practice
Btu	British thermal unit
BWR	boiling water reactor
CAA	Clean Air Act
CDF	core damage frequency
CDP	census-designated place
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
cm/sec	centimeters per second
CSA	combined statistical area
CWA	Clean Water Act (Federal Water Pollution Control Act)
CZMA	Coastal Zone Management Act
DAW	dry active waste
DBA	Design-basis accident

dBA	A-weighted decibels
Delta-T	differential temperature
DOE	Determination of Eligibility
DOT	U.S. Department of Transportation
DSM	demand-side management
EAB	exclusion area boundary
ECC	emergency closed cooling
ECCS	emergency core cooling system
EFH	essential fish habitat
EPA	U.S. Environmental Protection Agency
ER	environmental report
ESA	Endangered Species Act
ESW	emergency service water
F&O	Open Facts and Observations
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FES	final environmental statement
FFS	free flow speed
FPPA	Farmland Protection Policy Act
fps	feet per second
GEIS	NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
GHG	greenhouse gas
GPI	Groundwater Protection Initiative
GPP	groundwater protection program
gpm	gallons per minute
HABs	harmful algal blooms
HAPC	habitat areas of particular concern
HAPS	hazardous air pollutants
HEPA	high efficiency particulate air
I-90	Interstate 90
ICS	Integrated Computer System
IPA	integrated plant assessment

IPaC	Information for Planning and Consultation (USFWS website)
IPE	individual plant examination
IPEEE	individual plant examination for external events
in. Hg	inches of mercury
ISFSI	independent spent fuel storage installation
JVSD	joint vocational school district
KCLE	Cleveland, Ohio weather station
KERI	Erie, Pennsylvania weather station
km	kilometer
kV	kilovolt
kW	kilowatt
kWh	kilowatt hour
LLD	lower limit of detection
LLRW	low-level radioactive waste
LOS	level of service
LR	license renewal
LRA	license renewal application
LRW	liquid radioactive waste
LSD	local school district
MACCS2	MELCOR Accident Consequence Code System 2
Mb	body-wave magnitude (earthquakes)
mblg	magnitude short period surface wave (earthquakes)
MBTA	Migratory Bird Treaty Act
MCL	maximum containment level
MDCT	mechanical draft cooling tower
MG	million gallons
mg/L	milligrams per liter
MET	meteorological
MGD	million gallons per day
MGM	million gallons per month
MGY	million gallons of water per year
MM	modified Mercalli intensity (seismic intensity scale)

MMS	Meteorological Monitoring System
MMBtu	million British thermal units
MPC	multi-purpose canister
mph	miles per hour
mrem	millirem (milli roentgen equivalent man)
MSA	metropolitan statistical area
msl	mean sea level
MW	megawatt
MWe	megawatts electric
MWh	megawatt hour
MWt	megawatts thermal
NA	not available/not applicable
NAAQS	national ambient air quality standards
NCC	nuclear closed cooling
NCDC	National Climatic Data Center
NCEI	National Centers for Environmental Information
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NGCC	natural gas combined cycle
ng/L	nanograms per liter
NHI	Natural Heritage Inventory
NHPA	National Historic Preservation Act
NM	not measured
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NOV	notice of violation
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places

NRR	Nuclear Reactor Regulation
NWI	National Wetlands Inventory
NWS	National Weather Service
OCA	Owner Controlled Area
OCMP	Ohio Coastal Management Program
ODCM	offsite dose calculation manual
ODNR	Ohio Department of Natural Resources
ODNR-DWR	Ohio Department of Natural Resources Division of Water Resources
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
OHI	Ohio Historic Inventory
OL	operating license
OMS-OHC	Online Mapping System of the Ohio History Connection
OPSB	Ohio Power Siting Board
ORC	Ohio Revised Code
OSHA	Occupational Safety and Health Administration
OSSC	On-Site Storage Container
Pb	lead
pc/h	passenger cars per hour
PCB	polychlorinated biphenyl
pCi/L	picoCuries per liter
PE	particulate emissions
PEO	period of extended operation
PM-2.5	particulate matter less than 2.5 micrometers in diameter
PM-10	particulate matter less than 10 micrometers in diameter
PM	particulate matter
PNPP	Perry Nuclear Power Plant
PRA	Probabilistic Risk Assessment
psig	pounds per square inch gauge
PTIO	permit to install and operate
PV	photovoltaic
RCA	Radiological Controlled Area

RCRA	Resource Conservation and Recovery Act
Rd	Road
RECHAR	catalytic recombination and low temperature charcoal adsorption
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
RHR	residual heat removal
ROW	right-of-way
RTB	resistance temperature bulb
RWBCR	radwaste building control room
SAMA	severe accident mitigation alternative
SFDS	spent fuel dry storage
SHPO	state historic preservation officer
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasure
SRW	solid radioactive waste
SSA	sole source aquifer
SSC	systems, structures, and components
STC	source term category
STIP	Statewide Transportation Improvement Program
SU	standard pH unit
SWPPP	stormwater pollution prevention plan
TEDE	total effective dose equivalent
TWP	Township
UFSAR	updated final safety analysis report
UO_2	uranium dioxide
US 20	US Highway 20
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy

USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tanks
Vdc	volts of direct current
VOC	volatile organic compound

1.0 INTRODUCTION

1.1 Purpose of and Need for Action

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act (AEA) of 1954 as amended, and NRC implementing regulations. Energy Harbor Nuclear Generation LLC (Energy Harbor) is the owner of Perry Nuclear Power Plant (PNPP). Energy Harbor Nuclear Corp. operates PNPP Unit 1 pursuant to the NRC operating license (OL) NPF-58. The current Unit 1 OL will expire at midnight on November 7, 2026. PNPP is located on the shore of Lake Erie in Lake County in North Perry Village and Perry Township, Ohio, about thirty-five miles northeast of Cleveland, Ohio.

Energy Harbor has prepared this environmental report (ER) in conjunction with its application to the NRC for a renewal of the PNPP OL, as provided by the following NRC regulations:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application – Environmental Information [10 CFR 54.23], and
- Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)]

The NRC has defined the purpose and need for the proposed action, renewal of the OL for nuclear power plants such as PNPP, as follows (NRC 2013a):

> *The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decision-makers, such as State, utility, and, where authorized, Federal agencies (other than the NRC). Unless there are findings in the safety review required by the Atomic Energy Act or the NEPA [National Environmental Policy Act] environmental review that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of whether a particular nuclear power plant should continue to operate.*

The renewed OL would allow an additional 20 years of operation for the PNPP unit beyond its current licensed operating period. The renewed license for PNPP Unit 1 would expire at midnight November 7, 2046. Energy Harbor has prepared Table 1.1-1 to verify conformance with regulatory requirements. Table 1.1-1 indicates the sections in the PNPP license renewal (LR) ER that respond to each requirement of 10 CFR 51.53(c).

Table 1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements (Sheet 1 of 3)

Description	Requirement	ER Section(s)
Environmental Report-General Requirements [10 CFR 51.45]		
Description of the proposed action	10 CFR 51.45(b)	2.1
Statement of the purposes of the proposed action	10 CFR 51.45(b)	1.1
Description of the environment affected	10 CFR 51.45(b)	3.0
Impact of the proposed action on the environment	10 CFR 51.45(b)(1)	4.0
Adverse environmental effects which cannot be avoided should the proposal be implemented	10 CFR 51.45(b)(2)	6.3
Alternatives to the proposed action	10 CFR 51.45(b)(3)	2.6, 7.0, 8.0
Relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity	10 CFR 51.45(b)(4)	6.5
Irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented	10 CFR 51.45(b)(5)	6.4
Analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects	10 CFR 51.45(c)	2.6, 4.0, 7.0, 8.0
Federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and description of the status of compliance with these requirements	10 CFR 51.45(d)	9.1
Status of compliance with applicable environmental quality standards and requirements which have been imposed by federal, state, regional, and local agencies having responsibility for environmental protection, including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements	10 CFR 51.45(d)	9.5
Alternatives in the report including a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements	10 CFR 51.45(d)	9.7
Information submitted pursuant to 10 CFR 51.45(b) through (d) and not confined to information supporting the proposed action but also including adverse information	10 CFR 51.45(e)	4.0, 6.3, 7.0, 9.3, 9.5

Table 1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements (Sheet 2 of 3)

Description	Requirement	ER Section(s)
Operating License Renewal Stage [10 CFR 51.53(c)]		
Description of the proposed action including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with §54.21. The report must describe in detail the affected environment around the plant, the modifications directly affecting the environment or any plant effluents, and any planned refurbishment activities	10 CFR 51.53(c)(2)	2.1, 2.2, 2.3, 2.4, 3.0, 4.0
Analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for applicable Category 2 issues, as discussed below	10 CFR 51.53(c)(3)(ii)	4.0
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.5.1
Groundwater Resources		
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.5.2
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute [gpm])	10 CFR 51.53(c)(3)(ii)(C)	4.5.3
Groundwater quality degradation (plants with cooling ponds at inland sites)	10 CFR 51.53(c)(3)(ii)(D)	4.5.4
Radionuclides released to groundwater	10 CFR 51.53(c)(3)(ii)(P)	4.5.5
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling ponds)	10 CFR 51.53(c)(3)(ii)(B)	4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	10 CFR 51.53(c)(3)(ii)(B)	4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river	10 CFR 51.53(c)(3)(ii)(A)	4.6.3

Table 1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements (Sheet 3 of 3)

Description	Requirement	ER Section(s)
Terrestrial Resources		
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.6.4
Effects on terrestrial resources (non-cooling system impacts)	10 CFR 51.53(c)(3)(ii)(E)	4.6.5
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat	10 CFR 51.53(c)(3)(ii)(E)	4.6.6
Historic and Cultural Resources		
Historic and cultural resources	10 CFR 51.53(c)(3)(ii)(K)	3.8, 4.7
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)	10 CFR 51.53(c)(3)(ii)(G)	4.9.1
Electric shock hazards	10 CFR 51.53(c)(3)(ii)(H)	4.9.2
Environmental Justice		
Minority and low-income populations	10 CFR 51.53(c)(3)(ii)(N)	3.11.2, 4.10.1
Cumulative Impacts		
Cumulative impacts	10 CFR 51.53(c)(3)(ii)(O)	4.12
Postulated Accidents		
Severe accidents	10 CFR 51.53(c)(3)(ii)(L)	4.15
All Plants		
Consideration of alternatives for reducing adverse impacts for all Category 2 license renewal issues	10 CFR 51.53(c)(3)(iii)	4.0, 6.2
New and significant information regarding the environmental impacts of license renewal of which the applicant is aware	10 CFR 51.53(c)(3)(iv)	4.0, 5.0

1.2 Environmental Report Scope and Methodology

NRC regulations for domestic licensing of nuclear power plants require reviews of environmental impacts from renewing an OL. NRC regulation 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled, "Applicant's Environmental Report – Operating License Renewal Stage." In determining what information to include in the PNPP LR applicant's ER, Energy Harbor has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), Revision 1 (NRC 2013a), and referenced information specific to transportation (NRC 1999)
- NRC supplemental information in the *Federal Register* (78 FR 37282)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996a)
- *Regulatory Guide 4.2, Supplement 1, Revision 1, Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications* (NRC 2013b)

1.3 PNPP Licensee and Ownership

PNPP is owned by Energy Harbor and operated by Energy Harbor Nuclear Corp. Energy Harbor is a privately held energy producer and retailer, headquartered in Akron, Ohio (EH 2022a). Energy Harbor Nuclear Corp. operates the second largest non-regulated nuclear fleet in the country supplying roughly 33 terawatt hours of clean carbon free generation annually to their customers (EH 2022b).

2.0 PROPOSED ACTION AND DESCRIPTION OF ALTERNATIVES

2.1 The Proposed Action

In accordance with 10 CFR 51.53(c)(2) an LR applicant's ER must contain a description of the proposed action. The proposed action is to renew for an additional 20-year period, the OL for PNPP Unit 1, which would preserve the option for Energy Harbor Nuclear Corp. to continue operating PNPP and provide reliable baseload power for the 20-year proposed LR operating term. For PNPP Unit 1, the proposed action would extend the OL from November 7, 2026, to November 7, 2046.

Energy Harbor does not anticipate any license renewal-related refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC LR process. The relationship of refurbishment to LR is described in Section 2.3.

Changes to surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) would be implemented as a result of the 10 CFR Part 54 aging management review for PNPP. Potential SMITTR activities are described in Section 2.4. There are no plans associated with LR to modify the facility or its administrative controls other than the procedures necessary to implement the aging management programs described in the integrated plant assessment (IPA).

2.2 General Plant Information

> *The environmental report must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures. This report must describe in detail the affected environment around the plant and the modifications directly affecting the environment or any plant effluents.*
> *[10 CFR 51.53(c)(2)]*

The principal structures at PNPP include several contiguous buildings: the reactor building complex (Units 1 and 2), auxiliary buildings (Units 1 and 2), intermediate building, fuel handling building, control complex, radwaste building, turbine buildings, heater bays, turbine power complexes, water treatment building, diesel generator building, and the offgas buildings. Main structures outside the power block are the cooling tower, service water pumphouse, emergency service water pumphouse, circulating water pumphouse, independent spent fuel storage installation (ISFSI), training building, shooting range for security training, meteorological tower, 345-kilovolt (kV) switchyard, and various tanks, pumps, warehouses, and smaller buildings. (EH 2021a) Figure 3.1-1 shows the general features of the facility and the exclusion area boundary (EAB).

As discussed in Section 3.1.2, the PNPP exclusion area radius is 2,900 feet from the centerline of the Unit 1 reactor. All land within the exclusion boundary, with the exception of the switch yard, is owned by Energy Harbor. Control of the exclusion area, with the exception of the switch yard, including the mineral rights for oil, gas, and salt, is maintained by Energy Harbor Corp. (EH 2021a).

Regarding Unit 2, by way of a letter (PY-CEI/NRR-1845L) to the NRC on August 12, 1994, the Cleveland Electric Illuminating Company formally withdrew its request for extension of the Construction Permit for Unit 2. A Site Stabilization Plan was subsequently transmitted on December 29, 1994, (PY-CEI/NRR-1899L). This plan provided the activities needed to redress portions of the PNPP site affected by the Unit 2 construction activities. Systems and equipment that were originally to be shared by both units or intended for Unit 2 but are now used to support Unit 1 operations, have continued under the full control of the Unit 1 programs. Remaining Unit 2 areas, systems and equipment that no longer support Unit 1 have been "abandoned" in place or physically removed. The term "abandoned" from a licensing basis perspective implies that all systems, structures, and components important to safety remain intact but are no longer required for system/plant operation. (EH 2021a)

2.2.1 Reactor and Containment Systems

As shown in Figure 3.1-1, PNPP is a single unit (Unit 1) plant with a domed cylindrical steel containment vessel (EH 2021a). The plant has a boiling water reactor (BWR) nuclear steam supply system as designed and supplied by the General Electric Company and designated BWR/6, with a Mark III containment. An operating license for Unit 1 was issued in March 1986. Commercial operation of Unit 1 commenced in November 1987. (EH 2021a)

The nuclear system includes a direct cycle, forced circulation BWR that produces steam for direct use in the steam turbine. The unit utilizes a power conversion system in which components produce electrical power from the steam coming from the reactor, condense the steam into water and return the heated feedwater to the reactor. (EH 2021a)

PNPP performed a power uprate in 2000 to increase the maximum reactor core power level for facility operation from 3,579 megawatts thermal (MWt) to 3,758 MWt, which is a 5 percent increase in rated core power. The net electrical output is 1,277 megawatts electric (Mwe), and the gross electrical output is 1,327.6 MWe. (EH 2021a)

PNPP Unit 1 is designed to use 0.483-inch outer diameter fuel rods. The fuel assemblies contain uranium dioxide (UO_2) fuel clad with Zircaloy. The reactor core utilizes 748 fuel assemblies with 62 UO_2 rods per assembly with reload cycles based on a 24-month operating cycle design. (EH 2021a).

A few peripheral fuel assemblies are positioned and supported by fuel support pieces mounted on the core plate; otherwise, individual fuel assemblies in the core rest on fuel support pieces mounted on the top of the control rod guide tubes. The reactivity of the core is controlled by cruciform control rods and their associated mechanical hydraulic drive system. The assemblies are mechanically compatible and similar in design, but selected fuel rods in each assembly differ from the others in uranium enrichment. Each reload one-third of the core is removed and replaced with an equal number of fresh or reinserted bundles. (EH 2021a)

The control rods are cruciform in shape and are dispersed throughout the lattice of fuel assemblies. The control rods are positioned by individual control drives. The control rods are separated uniformly throughout the core on a 12-inch pitch maximum. Each control rod is surrounded by four fuel assemblies. (EH 2021a)

The bottom-entry cruciform control rod designs consist of several absorber tubes filled with neutron absorbing material such as B_4C and/or hafnium. The Zircaloy channels provide a fixed flow path for the coolant, serve as a guiding surface for the control rods, and protect the fuel during handling of the assembly. The mechanical reactivity control permits criticality checks during refueling and provides maximum plant safety. The core is designed to be subcritical at any time in its operating history with any one control rod fully withdrawn. (EH 2021a)

The core will have sufficient reactivity to produce the design power level and lifetime without exceeding the control capacity or shutdown margin. As per the requirements of 10 CFR 50.68(b)(7), PNPP is currently licensed for maximum enrichment of 5 percent U-235.

The reactor pressure vessel, reactor coolant recirculation loops and pumps are contained within a drywell. The drywell is a cylindrical reinforced concrete structure with a removable steel head. The drywell is contained within a leak tight containment vessel. The containment vessel is a cylindrical steel structure with a dome and flat bottom supported by a reinforced concrete foundation mat. Also, within the containment vessel is a suppression pool containing a large amount of water used to rapidly condense steam from reactor vessel blowdown or from a break in a major pipe. The shield building is a cylindrical concrete structure, with a domed top, completely enclosing the containment vessel. (EH 2021a)

The shield building structure provides shielding to minimize direct radiation to operating personnel and/or the public under normal operating and accident conditions. It also provides weather and external missile protection for the containment vessel. (EH 2021a)

2.2.2 Maintenance, Inspection, and Refueling Activities

Various programs and activities at the site maintain, inspect, test, and monitor the performance of plant equipment and are detailed throughout the updated final safety analysis report (UFSAR).

Maintenance of station safety-related structures, systems, and components is performed in accordance with written procedures, documented instructions, or drawings appropriate to the circumstances (for example, skills normally possessed by qualified maintenance personnel may not require detailed step-by-step delineation in a written procedure) which conform to applicable codes, standards, specifications, criteria, etc. When appropriate sections of related vendor manuals, instructions, or approved drawings, with acceptable tolerances do not provide adequate guidance to assure the required quality of work, an approved written maintenance procedure is provided.

Maintenance procedures are sufficiently detailed that qualified workers can perform the required functions without direct supervision. Written procedures, however, cannot address all contingencies, and therefore contain a degree of flexibility appropriate to the activities for which each is applicable.

Routine maintenance performed on plant systems and components is necessary for safe and reliable operation of a nuclear power plant. Some of the maintenance activities conducted at PNPP include inspection, testing, and surveillance to maintain current licensing basis of the plant and to ensure compliance with environmental and public safety requirements. Certain activities can be performed while the reactor is operating, others require that the plant be shut down. Outages are scheduled for refueling and certain types of repairs or maintenance, such as replacing of a major component.

Scheduled refueling outages commonly have a duration of an average of 30 to 41 days, depending on the workload. An additional 1,200-1,600 workers are onsite during a typical refueling outage. For PNPP, one refueling outage is scheduled approximately every 24 months.

2.2.3 Cooling and Auxiliary Water Systems

PNPP utilizes a closed-cycle cooling system including a natural draft cooling tower. Makeup water for the cooling system is obtained from Lake Erie through a submerged multi-port intake. (NRC 1982)

The Circulating Water System provides cooling water to the main and auxiliary condensers. Auxiliary water systems include the Service Water System, Emergency Service Water System, Closed Cooling Water Systems, Demineralized Water System, Fire Water System, Potable Water System, and the Ultimate Heat Sink. (EH 2021a)

2.2.3.1 Circulating Water System

The circulating water system at PNPP is a closed-cycle system designed to remove $8.35x10^9$ Btu/hr of heat from the condensers. Water flows from the cooling tower basin through a set of fixed screens to the suction of the circulating water pumps. The pumps discharge water through a 12-foot diameter pipe to the main and auxiliary turbine condensers, condensing the steam therein. From the condensers, water flows out to the cooling tower where it cascades through a set of baffles, is cooled by the air flow, and returns to the cooling tower basin. The cooling tower is approximately 411 feet in diameter at the base, and approximately 516 feet high. The distance from any point on the cooling tower to the nearest safety-related structure is more than 540 feet. (EH 2021a)

Makeup for tower evaporation, wind loss, and blowdown is obtained from the service water system. This system will provide the makeup requirements after cooling the various components that use service water. This water will come from Lake Erie via the intake tunnel into a service water pumphouse. Service water pumps transmit the water to the plant through various heat exchangers in the service water system. It then goes to a weir box from which flow is diverted to the cooling tower basin, with the remainder going directly to the lake by means of the discharge tunnel entrance structure. As shown in Figure 2.2-1, makeup flow to the cooling tower averages 25,980 gpm depending on atmospheric conditions. (EH 2021a)

A blowdown system is provided at the circulating water pump discharge to maintain the concentrated solids in the system at a design level of 2.5 concentrations of makeup water (service water). The blowdown is added to the service water discharge flow and is conveyed to the discharge tunnel entrance structure from which it will flow to the lake by means of the discharge tunnel. As shown in Figure 2.2-1, blowdown from the cooling tower averages 10,330 gpm depending on atmospheric conditions. (EH 2021a)

Cleanliness of the main condenser tubes is maintained using chemicals and biocide. Anti-scaling chemicals are added into the circulating water system, on an as-needed basis, to prevent scale deposition on heat exchanger surfaces. A liquid biocide injection system is used, as required, to minimize algae growth in the circulating and cooling water systems. The circulating water system, as well as the plant effluent water, consisting of cooling water discharge, and circulating water blowdown is monitored to determine biocide concentrations. Discharged effluent water quality will be maintained in accordance with PNPP's National Pollutant Discharge Elimination System (NPDES) permit. (EH 2021a)

2.2.3.2 Service Water System

PNPP utilizes a once-through service water system that supplies lake water to the unit for cooling the turbine building closed loop heat exchangers, the turbine lube oil coolers, and the nuclear closed cooling heat exchangers. The system also supplies water to the screen wash pumps. (EH 2021a)

Service water is obtained from Lake Erie at approximately 2,600 feet offshore and carried to the plant site through a 10-foot diameter intake tunnel located in the underlying bedrock. The water is returned to the lake through a similar discharge tunnel. (EH 2021a)

As shown in Figure 2.2-1, the service water flow from the service water pumphouse is 47,000 gpm. The amount of water not required for makeup is returned to the lake by way of the discharge tunnel water return line. (EH 2021a)

The service water system is non-safety-related and is not required for the safe shutdown of the reactor. However, the system is necessary for the operation and orderly shutdown, without damage to equipment, of the balance of the plant. (EH 2021a)

2.2.3.3 Emergency Service Water System

The emergency service water (ESW) system is a once-through system that provides cooling water to equipment required for normal and emergency shutdown of the reactor. The unit is also equipped with a separate emergency service water system that provides cooling water to residual heat removal (RHR) heat exchangers (A and B), Fuel Pool Cooling Heat Exchangers, emergency diesel generator heat exchangers, and emergency closed cooling system heat exchangers. It can also provide water to the site Fire Protection System, the Fuel Pool Cooling and Cleanup System, the Emergency Closed Cooling Water System, the RHR system (to provide containment flooding), and the Standby Liquid Control System. The system is designed with sufficient redundancy to ensure heat removal capability during shutdown, hot standby, accident conditions, and refueling operations. Redundant power supplies are provided for use in the event of loss of offsite power. (EH 2021a)

Each loop is supplied by a separate pump which is operated from a preferred power source or a standby power source (diesel-generator). Each loop is equipped with various indications of pressure, temperature, and flow in addition to alarms on the pump and other major components of the system. (EH 2021a)

The emergency service water pumps, located in the emergency service water pumphouse, are of the vertical type. Emergency service water to the pump intake structure is taken from Lake Erie. The primary source of water to the emergency service water pumphouse is supplied by a branch tunnel taken off the main intake tunnel to the service water pumphouse. (EH 2021a)

A liquid biocide injection system is used, as required, to minimize algae and plant growth. This is done on a regular basis at each individual pump suction. Sample points are provided in the discharge piping to determine biocide concentrations. Discharged effluent water quality will be maintained in accordance with PNPP's NPDES permit. (EH 2021a)

The design of the ESW system forebay incorporates traveling screens for removing submerged debris that may have entered through the intake structure. The water inlet is located approximately 2,600 feet offshore and submerged more than 15 feet below the surface of the lake. The intake system is designed for an approach velocity of 0.5 feet per second (fps) which diminishes the uptake of debris. It is highly unlikely that significant amounts of debris will enter the ESW pumphouse and clog the screens. (EH 2021a)

Two traveling screens are provided. Each screen has the capacity to supply water with all ESW pumps and fire protection pumps operating and still maintain a relatively low approach velocity minimizing debris accumulation and clogging potential. (EH 2021a)

2.2.3.4 Fire Protection System

The water supply for fire protection is taken from Lake Erie and can be supplied from either a motor-driven or diesel-driven fire pump. The fire pumps are located in the emergency service water pumphouse. (EH 2021a)

The two main PNPP fire pumps are rated at 2,500 gpm at 141 pounds per square inch gauge (psig) discharge head and are designed for manual or automatic starting. A looped distribution piping system is provided which is arranged and valved so that a single worst break in the distribution piping will not prohibit any fixed water system from getting the required flow at the required pressure. Design requirements include the capability of providing 500 gpm for hose streams operating simultaneously. Isolation valves are located to minimize the quantity of firefighting equipment out-of-service at one time, and to prevent a single break from disabling both the primary system and its backup. (EH 2021a)

The basis for the design of the fire protection program is to provide a defense-in-depth principle by achieving an adequate balance in:

- Preventing a fire from starting.
- Quickly detecting and extinguishing fires that do occur, thus limiting fire damage.
- Designing safety-related systems so that a fire that burns out of control for a considerable length of time (despite fire protection activities) will not prevent safe shutdown.

The fire protection program places special emphasis on detecting and suppressing fires which would endanger systems required for safe plant shutdown. The detection and protection systems are powered from electrical distribution systems which have backup power; where backup power is not available, self-contained battery-charger units are available unless analysis has shown that loss of the system will not compromise protection of safety-related or safe shutdown equipment to fire exposure. In addition, all open head suppression systems can be operated, and all closed head systems can be readied for operation without electric power. Backup fire suppression capability is provided throughout the plant. (EH 2021a)

The Fire Protection Program provides for periodic inspections and tests of plant fire protection equipment, systems, and features, with the minimum inspection and testing frequency based on the criteria described in the plant surveillance program for non-safety systems. (EH 2021a)

2.2.3.5 Closed Cooling Water Systems

2.2.3.5.1 Nuclear Closed Cooling System

The nuclear closed cooling system serves as a reliable source of cooling water to the auxiliary nuclear plant equipment. The system consists of a closed loop which acts as a barrier to prevent direct leakage of reactor water into the service water system. (EH 2021a)

During normal full power operation, the system flow is maintained by the necessary combination of three 50 percent capacity pumps with three 50 percent capacity heat exchangers dissipating the heat load to the service water. A surge tank is also provided to account for system volume variations. (EH 2021a)

During normal operation, water is supplied to the closed loop heat exchangers from the service water system at a maximum expected temperature of 81°F. In turn, the closed loop side supplies cooling water to each individual component at a maximum temperature of 95°F. The maximum total heat load expected is 145 x 10^6 Btu/hr and the maximum flow requirement is 23,000 gpm. (EH 2021a)

Demineralized water is used for initial system operation and system makeup. Quality is maintained by chemical addition to the system through a chemical addition tank. (EH 2021a)

2.2.3.5.2 Turbine Building Closed Cooling System

The turbine building closed cooling system serves as a reliable source of cooling water to the turbine plant components. The system consists of a closed cycle network in which treated condensate quality water is cooled with lake water in a heat exchanger and is circulated through the components being cooled. (EH 2021a)

The system includes three half-capacity pumps, two full-capacity closed-cycle cooling heat exchangers, a system surge tank, a chemical treatment tank, and a piping network to circulate the cooling water through the components being cooled. (EH 2021a)

The full-capacity heat exchangers are provided to cool the closed cycle cooling water. The heat exchangers are of the shell and tube type with lake water in the tubes and closed cooling water in the shell. (EH 2021a)

2.2.3.5.3 Emergency Closed Cooling System

The emergency closed cooling (ECC) system serves Unit 1 and is designed to provide a reliable source of cooling water to safety related components required for certain modes of normal reactor operation, as well as for accident conditions and loss of normal auxiliary power. The ECC system has two independent loops, each consisting of one pump, heat exchanger and a surge tank. A chemical addition tank is shared by both loops. The pumps may be operated from the preferred offsite power supply or from a standby onsite power source. Redundancy is provided in the electrical power supply and equipment in the emergency core cooling system (ECCS). (EH 2021a)

During normal operation, water from the two-bed water storage and distribution system is used for initial system operation and system makeup. In addition, a source of emergency makeup water is provided from the ESW system. Loops A and B of the ESW system supply the emergency makeup water to Loops A and B of the ECC system, respectively. (EH 2021a)

The ECC system is available, when required, to supply cooling water during the operation of the RHR system and portions of the ECCS for hot standby, normal shutdown, loss-of-coolant accident, and under loss of normal ac power. (EH 2021a)

2.2.3.6 Ultimate Heat Sink

Heat rejected from the turbine cycle during normal operation will be discharged to the atmosphere by a natural draft cooling tower, 516 feet high. During startup, shutdown, and emergency operation heat will be rejected to Lake Erie through the ESW system. This system draws water from the lake, cools the plant, and returns the water to the lake. The lake has been shown to have a sufficiently high level to assure that it is always available to qualify as a single source of cooling water. (EH 2021a)

Water is taken from Lake Erie by means of intake structures located approximately 2,600 feet offshore and 15 feet below the surface of the lake. A 10-foot ID intake tunnel conveys the water to two onshore pumphouse structures, the service water pumphouse and the ESW pumphouse. Water is returned to the lake after accomplishing its cooling function through the discharge tunnel entrance structure. The discharge nozzle is located approximately 1,650 feet offshore and 14 feet below the water surface. Intake structures and the discharge nozzle have been sized to carry a normal flow of 45,400 to 70,500 gpm. Intake velocity will vary from approximately 0.5 to 0.7 fps. The discharge nozzle has been designed so that the maximum flow of approximately 116,000 gpm can be adequately handled if both the emergency service water and the normal service water systems are operating simultaneously. (EH 2021a)

A redundant water supply to the emergency service water pumps is provided by a 10-foot diameter cross tie tunnel which allows an inflow of water to the emergency service water pumphouse forebay from the discharge tunnel in case flow through the normal intake tunnel is blocked off. (EH 2021a)

2.2.3.7 Demineralized Water Makeup System

The primary water source for the demineralized water makeup system is raw Lake Erie water supplied by the service water system. An alternate and/or supplemental water supply is from the potable water system. (EH 2021a)

The Lake Erie water is pretreated and transferred to a clearwell. Potable water can also be used as makeup to the clearwell in whole or in part. Part of the clearwell water is used for miscellaneous services and the remainder is used for plant makeup to the demineralizers. The demineralizer system is not safety related. The system is designed to produce sufficient water to meet plant makeup requirements. The demineralized water is used to supply miscellaneous services and makeup to the condenser, or alternatively, the condensate storage tank. (EH 2021a)

2.2.3.8 Potable and Sanitary Water System

The potable water system supplies and distributes both hot and cold water throughout the plant for potable and sanitary purposes. The system supplies hot and cold water in sufficient quantities for potable and sanitary purposes to the service building, control complex, turbine building, and numerous other buildings inside and outside of the protected area. The system supplies cold water for safety (emergency personnel) showers and eye washes in various plant locations as required. (EH 2021a)

The supply of potable and sanitary water is obtained from the Lake County Department of Utilities water main, which is extended onto the site. Potable water is distributed to the plumbing fixtures located in the plant. (EH 2021a)

Backflow preventers are located in the system's connection with the offsite water source. The backflow preventers inhibit flow from the site to the offsite water supply. If the potable water system became potentially contaminated, the backflow preventers would ensure that the offsite supply would not be affected. (EH 2021a)

2.2.4 Meteorological Monitoring Program

The PNPP meteorological (MET) monitoring system is designed to fulfill the requirements of NUREG-0737, Item III.A.2.2, Meteorological Data. The MET monitoring system meets the criteria of Regulatory Guide 1.23, Revision 0, Onsite Meteorological Programs for programmatic aspects. The MET monitoring system instrumentation meets the criteria of Regulatory Guide 1.97, Revision 2, and is classified as Type E, Category 3. The MET monitoring system consists of one tower located approximately 6,000 feet inland and 4,300 feet away from the cooling tower. The MET tower location is illustrated in Figure 3.1-1.

The MET monitoring tower consists of a 60-meter tower instrumented with equipment at the 10- and 60-meter levels. The elevation at the base of the tower is approximately 645 feet above mean sea level (msl). The terrain is flat with grasses, small shrubs, and small trees. The terrain is similar to the site region. Because of the similarity in terrain, the meteorological data collected on the tower is reasonably representative of the site region.

The meteorological tower is a guyed Rohn Model 80. The triangular open-latticed tower is 41 inches center-to-center on a side. The sensors are fastened on booms out to the west from the tower. The current monitoring system consists of two nearly identical systems, A and B. Each system has a wind speed, wind direction, and temperature sensor installed at 10 and 60 meters. At both levels, System A sensors are positioned approximately 9 feet from the tower on swing-out booms, while system B sensors positioned 11.5 feet from the tower on slide-out booms. In addition, aspirated temperature sensors are mounted six feet from the tower at each level for both A and B. There is also a dew point temperature sensor mounted on the tower at the 10m level and precipitation and station pressure sensors located at the surface near the base of the tower.

Both systems include a data logger, communication modem, and computer data acquisition components housed in the instrument shelter. Fiber optic lines transfer the meteorological sensor outputs to the Plant Integrated Computer System (ICS).

One environmentally controlled instrument shelter is located at the base of the tower. The shelter houses the signal conditioning equipment, the data communications equipment, and serves as a maintenance center. The shelter contains System A and B instrument racks, the power distribution system, an environmental control unit to maintain shelter temperature, a surge protection panel, and a barometric pressure sensor.

The wind speed and wind direction sensors for Systems A and B are identical. Wind speed is measured by a three-cup anemometer and wind direction is sensed by a wind vane. Each anemometer and vane drive a transmitter element that sends a signal to a signal processor. The output of the processor is a 0-5 volts of direct current (Vdc) signal that is proportional to the output of the sensor. This signal is sent to the data logger and the ICS. For wind speed, the 0-5 Vdc signal equates to 0-100 mph and for wind direction, the 0-5 Vdc signal corresponds to wind vane angles of 0°- 540°.

The four ambient temperature sensors for Systems A and B are identical. Ambient air temperature is measured by a four-wire platinum resistance temperature bulb (RTB) that is mounted in a mechanically aspirated radiation shield assembly. The aspirated radiation shield assembly is used to ensure that the RTB measures ambient air temperature, independent of solar, atmospheric, or terrestrial heat radiation. The motorized aspirator airflow through the radiation shield assembly is monitored by a flow switch. If flow stops, the flow switch causes the output voltage to go to a pre-set value, which indicates a failed aspirator.

A differential temperature (Delta-T) between the upper and lower platforms is calculated using the ambient air temperature measured at each level. The output temperature and the Delta-T signals are 0-5 Vdc, with the temperature range being -20°F to +100°F, and the Delta-T range being -6°F to +12°F. The 0-5 Vdc signals are sent to the data logger and ICS.

Dew point is measured by one sensor on System A. The sensor contains an optical sensing bridge, a thermoelectric cooler, and an aspirated RTB which work together to sense the dew point or the frost point. The dew point output signals are 0-5 Vdc, with the scale range being -20.0°F to +100°F. The frost point scale range is -20.0°F to +32°F.

Precipitation is measured by one monitoring gauge on System A. The precipitation monitor consists of a tipping bucket-type rain gauge and a signal processor. The processor output signal is 0-5 Vdc, with the measurement range being 0-1 inch. The tipping bucket is located at ground level near the base of the meteorological tower. It includes a thermostatically controlled heater for measuring the melted equivalent of frozen precipitation, i.e., snow, sleet, freezing rain.

Station pressure is measured by a single sensor in System A and is composed of a barometric pressure sensor located inside the instrument shelter. The signal is sent to a processor whose output signal is sent to the data logger and ICS. The range of the system, 0-5 Vdc, is equivalent to 20 to 32 inches of mercury (in. Hg.).

Both systems provide multiple channels for communicating data to the plant computer for dispersion modeling and dose assessment as part of the emergency dose assessment calculation and are available on monitors in the Control Room. The information sent includes direct analog meteorological sensor information for emergency dose assessment calculations. Meteorological data is also available via remote dial-in to the System A or B data loggers.

If the System A or B 10 meters wind speed, wind direction, sigma theta, 10 meters ambient temperature, or Delta–T are unavailable or invalid, the equivalent data from the redundant system will be provided for input to the emergency dose assessment computer program. Regional weather data is also available for manual input to the emergency dose program from the Cleveland Hopkins National Weather Service (NWS) Office.

During plant computer outages, the Meteorological Monitoring System (MMS) is designated to allow remote telephone access of meteorological data. The MMS data is retrieved by direct dial-up to the System A or B data loggers. MMS data can also be obtained directly from the data loggers at the instrument shelter.

To ensure the accuracy of the meteorological program at PNPP, the system is subject to quality assurance and quality control procedures. The meteorological tower is maintained under an approved Quality Assurance Program. The operation of the meteorological system is evaluated on a routine basis. A weekly inspection is conducted to verify proper system operation and to perform routine operations and limited preventative maintenance. Emergency maintenance between regularly scheduled surveillance procedures is performed as needed. Field service activities performed on the PNPP MET system are dispositioned in accordance with PNPP Records Management System.

PNPP retains monthly and annual meteorological data recovery rates. Regulatory Guide 1.23 calls for a 90 percent annual data recovery on variables used for dispersion modeling (i.e., 10 m wind speed, wind direction, and Delta-T). Based on the previous 5 years (2017-2021) the meteorological data recovery rate at PNPP has been greater than 90 percent, except for November 2018 to May 2019 due to a damaged precipitation instrument. Meteorology and air quality at PNPP are discussed in detail in Section 3.3. Meteorological parameters monitored at PNPP are listed in Table 2.2-2.

2.2.5 Power Transmission System

As required by 10 CFR Part 51, Table B-1, and NRC Regulatory Guide 4.2 (NRC 2013b), transmission lines subject to evaluation of environmental impacts for LR are those that connect the nuclear power plant to the switchyard where electricity is fed into the regional power distribution system and power lines that feed the plant from the grid during outages. (EH 2021a)

In-scope transmission lines are those from the turbine building to the 345-kV switchyard. The area between the turbine building and the switchyard is within the Owner Controlled Area (OCA) area and inaccessible to the public, as shown in Figure 2.2-2.

PNPP consists of one 1,277 MWe (net) operating unit which generates power at 22-kV. The power from the unit is fed via an isolated phase bus to the unit's main transformer, stepped up to 345-kV and delivered to the 345-kV switchyard. The 345-kV switchyard includes four transmission circuit terminals. The switchyard is arranged in a minimum breaker-and-a-half configuration and serves as the interface between the preferred source (two startup transformers) and the offsite transmission network. (EH 2021a)

The 345-kV system does not perform any safety related function and is classified as non-safety related. The 345-kV distribution system performs the following functions:

- Transmits power generated at PNPP to the 345-kV grid.
- Provides standby power to PNPP auxiliaries during unit startup, shut down, and after reactor trip.
- Provides a reliable source of normal power to PNPP engineered safeguards equipment.
- Acts as an interconnecting terminal for the two 345-kV lines at PNPP.

The design of the system is such that sufficient independence or isolation between the various sources of electrical power is provided to guard against concurrent loss of all auxiliary power. The loads connected to the Class 1E buses are normally supplied from the preferred offsite power system. On complete loss of offsite power or system voltage degradation, the Class 1E bus safety system loads are automatically transferred to the onsite diesel generators. (EH 2021a)

In Unit 1, electrical energy generated at 22-kV AC is transformed to 345-kV AC by the unit's main transformer and delivered to the 345-kV switchyard. As shown in Figure 2.2-2, the 345-kV switchyard is located on the west side of PNPP adjacent to the protected area fence. (EH 2021a)

The 345-kV transmission station is a minimum breaker-and-a-half configuration. The plant's two startup transformers are directly connected to the 345-kV main buses. The two full capacity main buses are on opposite sides of the transmission station and are physically independent. Specific design features of the transmission station are as follows:

The interface between the transmission station and Class 1E power system consists of 345-kV transmission circuits, disconnect switches, startup transformers, circuits in cable tray and underground duct banks, interbus transformers, and 5 and 15-kV switchgear. Several additional paths from the transmission system to the Class 1E system are available as alternate offsite power sources if loss of a startup transformer occurs. (EH 2021a)

The 345-kV switchyard is directly connected to four independent transmission stations. Thus, the loss of any single transmission station will have a negligible impact on the availability of the preferred source. Within the plant property, 345-kV transmission lines are supported on double circuit structures. Any two of the four 345-kV circuits exiting the switchyard may be out-of-service with the unit operating, and the remaining circuits will be capable of carrying the units' output. (EH 2021a)

The 345-kV transmission lines approach the transmission substation on a common right-of-way (ROW) corridor within 0.9 miles of the transmission substation. The structures are set far enough apart to avoid the possibility of causing an outage of all lines due to postulated structural collapse of one line. The transmission towers have been designed for worst case environmental conditions and tested beyond the governing National Electric Safety Code (NESC) requirements. The switchyard components are arranged such that no single event will result in the loss of the unit and the availability of all offsite sources. (EH 2021a)

2.2.5.1 Vegetation Management Practices

The in-scope transmission lines are within the PNPP site boundary. The transmission lines cross the PNPP industrial area, where vegetation is sparse and only minimal vegetation management is needed.

2.2.5.2 Avian Protection

Threatened and endangered species potentially occurring near PNPP, or within counties in a six-mile radius of PNPP, are described in Section 3.7.7. As discussed in the site environmental program, PNPP's interaction with birds is in accordance with guidance from the U.S. Fish and Wildlife Service (USFWS).

2.2.5.3 Public

All in-scope transmission lines are located completely within Energy Harbor-controlled property. Therefore, the public does not have access to this area and, as a result, no induced shock hazards exist for the public.

2.2.5.4 Plant Workers

NUREG-1437 suggests that occupational safety and health hazard issues are generic to all types of electrical generating stations, including nuclear power plants, and can be minimized when the workers adhere to safety standards and use protective equipment (NRC 2013a).

PNPP maintains safety-specific policies for all electrical work conducted on site at electrical transmission locations. PNPP's electrical safety procedure establishes the electrical safety practices to implement an effective electrical safety program and applies to all personnel performing electrical work at PNPP.

2.2.6 Radioactive Waste Management System

The primary design objective of the solid radioactive waste (SRW) system is to control, collect, handle, process, and package all wet and dry solid radioactive waste generated by PNPP as a result of normal operation, and to store these wastes until they are shipped to authorized receiving and storage areas offsite. Packaging of solid radioactive material is accomplished in a manner which ensures that no radioactive material will be released to the environment during shipment of the waste to offsite burial or storage facilities. (EH 2021a)

The waste disposal system collects and processes all potentially radioactive reactor plant wastes for disposal within limitations established by applicable governmental regulations.

The offsite dose calculation manual (ODCM) for PNPP describes the methods used for calculating the concentration of radioactive material in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from PNPP. The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with the NRC regulations. (EH 2021a)

Fuel assemblies that have exhausted a certain percentage of their fuel and are removed from the reactor core for disposal contain spent fuel. The spent fuel is currently stored onsite in the spent fuel pool in the fuel handling building or in dry cask storage containers at the onsite ISFSI. Spent fuel is stored in the PNPP ISFSI under a separate general license.

Arrays of high density spent fuel storage racks are provided in the fuel preparation and storage pool, and in the spent fuel pool located in the fuel handling building. (EH 2021a) The high-density racks provide storage spaces for a total of 4,020 spent fuel assemblies and 30 spaces for multi-purpose storage of containers for failed fuel, channels, or control rods. (EH 2021a)

PNPP has an on-site ISFSI facility that is used for storage of spent nuclear fuel. The Spent Fuel Dry Storage (SFDS) operations at PNPP are conducted under a general license in accordance with 10 CFR 72. The ISFSI site is located inside the protected area fence, southeast of the fuel handling building. The ISFSI pad is designed for a capacity of 80 storage units. The PNPP ISFSI utilizes the HOLTEC International (HOLTEC) HI-STORM 100 SFDS system. The SFDS system includes the HI-STORM 100S Version B storage cask and the MPC-68 multi-purpose canister (MPC). (EH 2021a) PNPP upgraded to the MP-89 and HI-STORM FW cask in September 2022 while continuing to use the 100S system for existing spent fuel storage. Currently the ISFSI has 25 MPC-68 and two MPC-89 systems on the pad leaving room for 53 additional systems. The current ISFSI pad design in concert with the planned loading footprint will accommodate these 53 systems, taking into account the transition to the new Holtec HI-STORM FW casks and MPC-89 canisters. This leaves adequate capacity in the ISFSI pad to operate the unit through life extension to 2046.

2.2.6.1 Liquid Radioactive Waste Processing System

The liquid radioactive waste (LRW) system collects, monitors, treats, stores and recycles or releases liquid wastes produced in the plant. These wastes are collected in sumps and drain tanks at various locations throughout the plant and then transferred to collection tanks in the radioactive waste facility for treatment, storage, recycle, or release. (EH 2021a)

During normal plant operation, the waste disposal system processes liquids from the following sources (EH 2021a):

- High purity/low conductivity wastes (primarily equipment drains)
- Medium-to-low purity/medium conductivity wastes (primarily floor drains)
- High conductivity chemical wastes, and
- Detergent drains

High purity/low conductivity wastes are collected in one of two waste collector tanks, each sized to hold one day's maximum normal input. Except for equipment drains, these waste streams can be diverted to the floor drain collector tanks if water quality or flow conditions warrant. After a batch of waste is collected, it is sent through a traveling belt filter to remove suspended solids, and then a mixed bed demineralizer to remove dissolved solids. Two waste sample tanks, each sized to hold one batch of waste, are provided for sampling, mixing and temporary storage of the treated effluent. After a batch is sampled, it may be recycled to the waste collector tank for further treatment, sent to the condenser hotwell (normal path), the condensate storage system or discharged. The system is completely redundant, either through backup equipment or crossties with identical equipment in one of the other subsystems. (EH 2021a)

The major inputs to the high purity subsystem are equipment drains. The equipment drain piping in each structure housing radioactive (or potentially radioactive) fluid systems is routed to a sump located at the lowest elevation of the building. After one of these sumps is filled, one of two redundant, vertical sump pumps automatically pumps the contents to the waste collector tanks in the LRW system. (EH 2021a)

Medium-to-low purity/medium conductivity wastes are collected in one of two floor drain collector tanks, each sized to hold approximately three days maximum normal input. With the exception of floor drains, these waste streams can be diverted to the waste collector tanks if water quality or flow conditions warrant. After a batch is collected, it is normally filtered, demineralized, and re-used. Two floor drain sample tanks, each sized to hold one batch of waste, are provided for sampling and temporary storage of treated effluent. After sampling, a batch is either recycled for further treatment, sent to condenser hotwell (normal path), the condensate storage system or discharged. The system is completely redundant, either through backup equipment or crossties with identical equipment in one of the other subsystems. (EH 2021a)

The major inputs to the medium-to-low purity subsystem are floor drains, which consist of miscellaneous unidentified equipment leakage and floor washdown. The floor drain piping in each structure housing radioactive (or potentially radioactive) fluid systems is routed to a sump located at the lowest elevation of the building. After one of these sumps is filled, one of two redundant, vertical sump pumps automatically sends the contents to the floor drain collector tanks in the LRW system. (EH 2021a)

Detergent drains consist of personnel decontamination solutions and floor drains from nonradioactive areas of the control complex. Cleaning of protective clothing is performed onsite and/or contracted offsite. All waste inputs are collected in the laundry and floor drains sump located at the lowest elevation of the control complex. When this sump is filled, one of two redundant sump pumps automatically transfers the contents to the LRW system detergent drains tanks. The waste is then collected and manually drained to the Radwaste Floor Drain so that it can be processed. (EH 2021a)

In addition to handling the above categories of liquid waste, the LRW system collects spent resin slurries and filter backwash slurries prior to being sent to the SRW disposal system. Spent resins from the mixed-bed condensate demineralizers, waste demineralizer, floor drains demineralizer, and suppression pool demineralizer are collected in two spent resin storage tanks. Each tank is sized to hold the resins for six months. The spent resins are transferred to the SRW disposal system as a water slurry. (EH 2021a)

Backwash slurries from the condensate filter, fuel pool filter/demineralizer and reactor water clean-up system filter/demineralizer backwash receiving tanks are pumped to settling tanks located in the radwaste building. The sludge is allowed to settle to the bottom of these tanks while relatively clean water is drawn off the top and pumped to the floor drain collector tanks or waste collector tanks for further treatment. Periodically, the sludge is transferred to the SRW disposal system as a water slurry. (EH 2021a)

Except for detergent wastes, all liquid effluents from the LRW system are normally routed to the condensate storage system or main condenser for reuse in the plant. This is done on a batch basis after a sample of the effluent is taken to determine if it is suitable for reuse. If the sample does not meet the water quality standards for condensate makeup the batch is either recycled for further treatment or discharged through the discharge tunnel entrance structure, depending on the chemical content and activity level. (EH 2021a)

All streams to be discharged, except for the atmospheric drain line from the turbine building supply plenums are routed through one central flow control station, where a flow control valve is used. These valves are modulated remote-manually from the radwaste building control room (RWBCR) to achieve the desired flow rate. The stream is then monitored for gross gamma activity and routed to the discharge tunnel entrance structure, which discharges to the environment. (EH 2021a)

The liquid waste discharged to the environment from the LRW systems is diluted by the service water and/or emergency service water of Unit 1. Releases to the environment are by way of the discharge tunnel entrance structure or to the plant storm drains for the discharge from the atmospheric drain line on the turbine building supply plenums. (EH 2021a)

The radiation monitoring system monitors the effluent, closing the discharge valve if the amount of radioactive material in the effluent exceeds preset values. These values are established using the methodology described in the ODCM. (EH 2021a)

PNPP does not anticipate any increase in liquid waste releases beyond normal operations during the proposed LR operating term.

2.2.6.2 Gaseous Radioactive Waste Management System

PNPP ventilation is designed to maintain gaseous effluents to levels as low as reasonably achievable (ALARA). This is done by a processing and controlling the release of gaseous radioactive wastes to the site environs so that the total radiation exposure to persons outside the Radiologically Controlled Area does not exceed the maximum limits of the applicable regulations even with some defective fuel rods. (EH 2021a)

During plant operations, off-gases from the main condenser are the major source of gaseous radioactive wastes. (EH 2021a)

The treatment of these gases includes the following (EH 2021a):

- Volume reduction through a catalytic hydrogen-oxygen recombiner
- Water vapor removal through a condenser
- Decay of short-lived radioisotopes through a holdup line
- Further condensation and cooling
- Filtration
- Adsorption of isotopes on activated charcoal bed
- Further filtration through high efficiency filters

A main condenser off-gas treatment system has been incorporated in the plant design to reduce the gaseous radwaste emission from the station. The off-gas system uses a catalytic recombiner to recombine radiolytically dissociated hydrogen and oxygen. After cooling (to approximately 130°F) to strip the condensable gases and reduce the volume, the remaining non-condensables (principally air with traces of krypton and xenon) will be delayed in the nominal 10-minute holdup system. The gas is cooled to 45°F and filtered through a high-efficiency particulate air (HEPA) filter. The gas is then passed through a desiccant dryer that reduces the dewpoint between 0°F and -40°F and is then further chilled prior to entering the charcoal adsorption beds. (EH 2021a)

Charcoal adsorption beds, normally operating in a refrigerated vault between 40°F and 0°F, selectively adsorb and delay the xenons and kryptons from the bulk carrier gas (principally dry air). After the delay, the gas is again passed through a HEPA filter and discharged to the environment through the off-gas building vent. PNPP is currently implementing modifications to operate the system at ambient temperature without refrigeration. (EH 2021a)

The offgas from the main condenser steam jet air ejector is treated by a system using catalytic recombination and low temperature charcoal adsorption (RECHAR) system. Non-condensable radioactive offgas is continuously removed from the main condenser by the air ejector during plant operation. (EH 2021a) The discharge from the condenser steam jet air ejector is processed by the low-temp RECHAR system prior to release through the off-gas building vent. The estimated releases are a small fraction of the limits of 10 CFR 20 and are ALARA. (EH 2021a)

PNPP does not anticipate any increase in gaseous waste releases beyond normal operations during the proposed LR operating term.

2.2.6.3 Solid Radioactive Waste Management System

The SRW management system is designed to control, collect, handle, process, and package all wet and dry solid radioactive waste generated by PNPP as a result of normal operation, and to store these wastes until they are shipped to authorized receiving and storage areas offsite. This is done in such a manner that, for all anticipated quantities of waste produced, the availability of the power plant for power generation will not be adversely affected. (EH 2021a)

Packaging of solid radioactive material is accomplished in a manner which ensures that no radioactive material will be released to the environment during shipment of the waste to offsite burial or storage facilities. The SRW system is designed to limit exposures to both operating personnel and the general public to ALARA. (EH 2021a)

The SRW system is designed to process spent resin slurry, precoat-type filter backwash slurry, and traveling belt discharge cake. These waste streams are transferred from the LRW system collection tanks to a vendor's dewatering system. (EH 2021a)

Processing of the waste is controlled from the SRW control panel and vendor system control panel. Using selector switches on this panel, the operator selects which waste storage tank to take waste from filling the waste container is controlled from the vendor system control panel. (EH 2021a)

Once onsite processing of the waste is complete, the overhead bridge crane picks up the container and takes it either to a short-term storage area or to a truck bay where it is loaded for transfer to an authorized receiving, reprocessing, or storage area. (EH 2021a)

A dry solid radwaste subsystem is provided for processing dry filter media (ventilation filters), contaminated clothing, equipment, tools and glassware, and miscellaneous radioactive wastes that are not amenable to solidifications prior to packaging. (EH 2021a)

Potentially radioactively contaminated waste and radioactive material such as tooling, components, and equipment are collected throughout the Radiological Controlled Area and brought to one of two main areas: the Waste Abatement and Reclamation Facility or the Dry Active Waste (DAW) handling area on the 623.5-footelevation of the radwaste building. Other areas may be established temporarily based on operational needs as determined by the Radiation Protection Manager. (EH 2021a)

A shielded area located adjacent to the radwaste truck bay on the 620' elevation of the radwaste building, measuring 50′-6″ long by 25″-6″ wide by 13′-4″ high (usable height) is used to provide temporary onsite storage of packaged waste. This allows for further decay time and lessens the effect on plant operations from such events as a trucker's strike or temporary shutdown of a burial site. (EH 2021a)

Radioactive waste collected onsite awaiting disposal off-site is called temporary storage or staged waste. Any radioactive waste remaining on-site greater than 90 days will have waste form and container selection considered for impact and must comply with Generic Letter 81-38. (EH 2021a)

2.2.6.4 Ultimate Disposal Operations

All packages containing radioactive non-fissionable material, and the procedures used to prepare these for offsite shipment, are in accordance with U.S. Department of Transportation (DOT) regulations. All shipments are made in accordance with the state, NRC, and DOT regulations, and appropriate PNPP and Energy Harbor fleet procedures.

PNPP has a contract with Energy Solutions and Erwin Resin Solutions for the processing and disposal of all radiologically contaminated material. Amounts and types of radioactive waste are reported annually to the NRC via the annual radiological effluent release report (ARERR).

Radioactive Waste is stored at the PNPP On-Site Storage Container (OSSC) Yard. The last shipment of OSSC Yard materials was made in 2016.

2.2.6.5 Low-Level Radioactive Waste

Low-level radioactive waste (LLRW) is classified as Class A, Class B, or Class C (minor volumes are classified as greater than Class C). Class A is waste includes both DAW and processed waste (e.g., dewatered resins). Classes B and C normally include processed waste and/or irradiated hardware. PNPP has contracts with the following listed vendors for disposal of LLRW:

- Energy Solutions
- Unitech Services
- Waste Control Specialist-Future

Currently, PNPP has no waste greater than Class C stored onsite. Disposal of waste greater than Class C is the responsibility of the federal government.

2.2.6.6 Low-Level Mixed Waste

Mixed waste is radioactive waste that contains or consists of waste constituents that the U.S. Environmental Protection Agency (EPA) lists as hazardous waste. Therefore, any mixed waste is under the regulatory requirements of the NRC and the EPA. Every effort is made to minimize or eliminate mixed waste generation at PNPP.

PNPP is an infrequent and episodic generator of mixed waste. If generated, low-level mixed waste is stored in the service building hot shop until disposed. However, PNPP does not currently have any mixed waste stored onsite. PNPP last generated mixed waste in April 2014.

2.2.7 Nonradioactive Waste Management System

The Resource Conservation and Recovery Act (RCRA) governs the disposal of solid waste. Solid and hazardous wastes in Ohio are regulated and administered by Ohio Environmental Protection Agency (OEPA).

PNPP generates nonradioactive waste as a result of plant maintenance, cleaning, and operational processes that occur at the site. Table 2.2-2 provides the amount of nonradioactive hazardous, nonhazardous, and recycled wastes generated at PNPP from 2016-2021. Nonradioactive waste commonly generated at PNPP include paint wastes, aerosol cans, solvent waste, off-specification chemicals, occasional spill cleanup debris, universal wastes consisting of fluorescent lamps, batteries, and mercury containing devices. PNPP recycles universal wastes in accordance with Energy Harbor fleet procedures.

PNPP maintains a list of approved waste vendors currently used to manage and dispose of hazardous, nonhazardous, and recyclable wastes generated.

Currently the following vendors are utilized at PNPP:

- PSC Cousins
- ERG (Lamps Inc.)

Table 2.2-1 Meteorological Parameters Monitored at PNPP

Parameter	Tower (elevation level)
Wind Speed	10 meters, 60 meters
Wind Direction	10 meters, 60 meters
Delta T	(60-10) meters
Ambient Temperature	10 meters, 60 meters
Dewpoint Temperature (System A)	10 meters
Station Pressure (System A)	Yes
Rainfall (System A)	Yes

Table 2.2-2 Nonradioactive Waste Quantities at PNPP

Year	Hazardous, Nonhazardous, and Recycled Waste (pounds)
2017	69,228.29
2018	47,230.97
2019	131,952.26
2020	114,674.30
2021	145,716.48

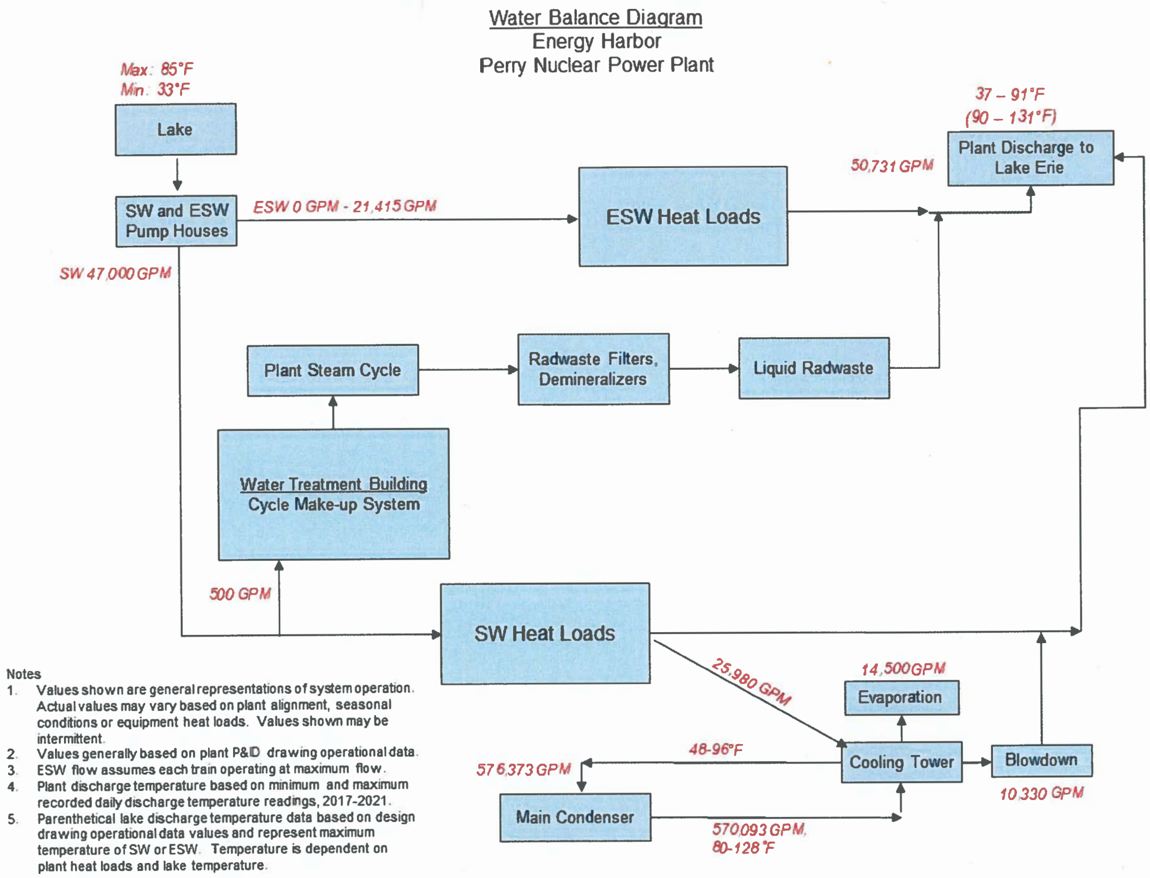


Figure 2.2-1 PNPP Typical Water Balance Diagram

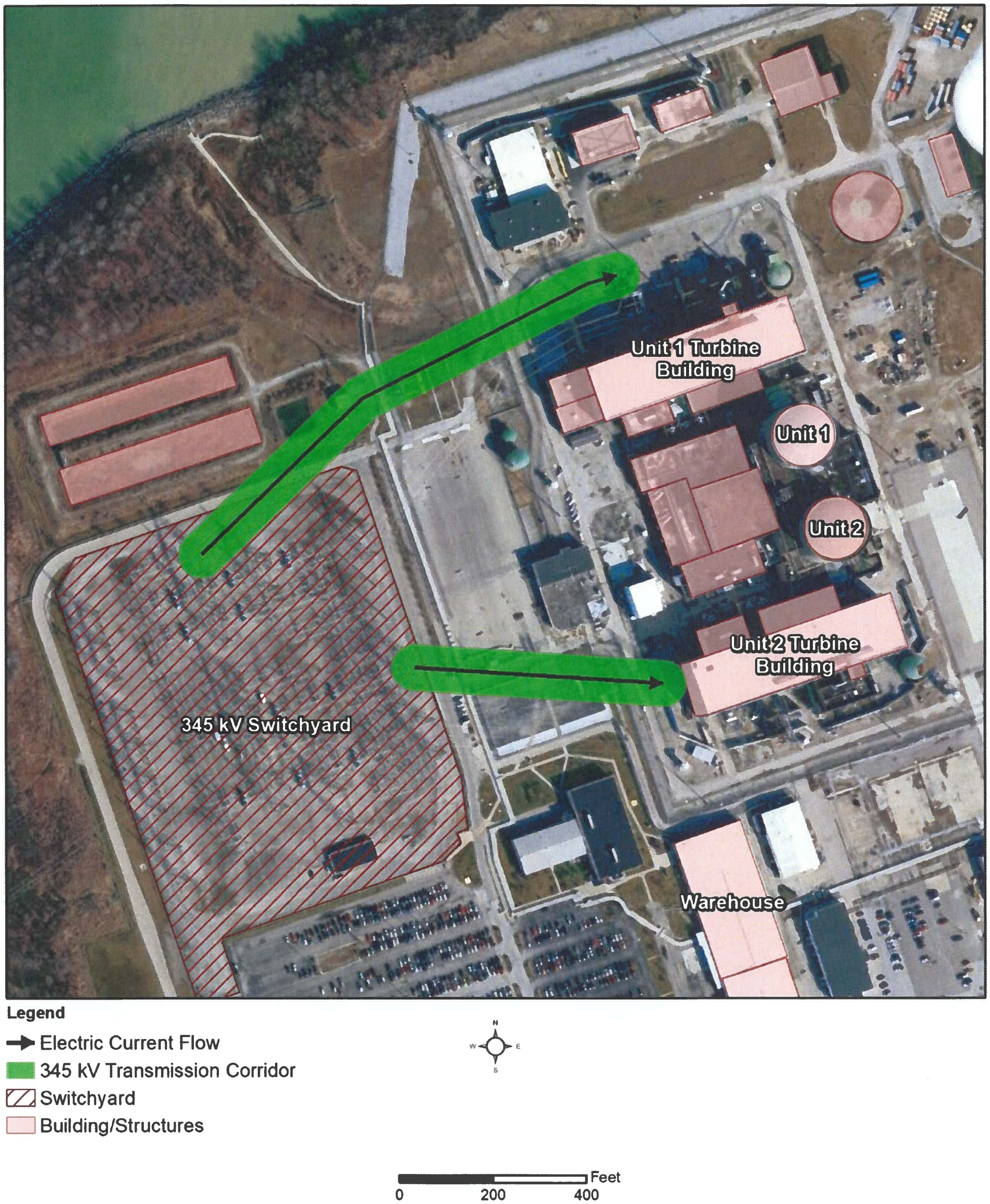


Figure 2.2-2 In-Scope Transmission Lines

2.3 Refurbishment Activities

In accordance with 10 CFR 51.53I(2), an LR applicant's ER must contain a description of the applicants plan to modify the facility or its administrative control procedures as described in accordance with § 54.21. If LR-related refurbishment is planned at a facility, the applicant's ER would include analysis for environmental impacts of the proposed refurbishment activity. [10 CFR 51.53(c)(3)(ii)].

The incremental aging management activities implemented to allow operation of a nuclear power plant beyond the original 40-year license term were assumed to fall under one of the two broad categories. One of these categories involves refurbishment actions, which usually occur infrequently and possibly only once in the life of the plant for any given item. The other category is SMITTR actions, most of which are repeated at regular intervals and schedules.

The NRC requirements for the renewal of OLs for nuclear power plants include preparation of an IPA [10 CFR 54.21]. The IPA must identify systems, structures, and components (SSCs) subject to an aging management review. The objective of the IPA is to determine whether the detrimental effects of aging could preclude certain SSCs from performing in accordance with the current licensing basis during the additional 20 years of operation requested in the LR application (LRA). An example of an SSC subject to aging is the reactor vessel.

PNPP's IPA, which Energy Harbor conducted under 10 CFR Part 54 and is described in the body of the LRA, has identified no LR related refurbishment or replacement actions needed to maintain the functionality of SSCs, consistent with the current licensing basis, during the proposed LR operating term. Energy Harbor does not anticipate the continued operation of PNPP to result in any environmental impact greater than SMALL.

2.4 Programs and Activities for Managing the Effects of Aging

In accordance with 10 CFR 51.53(c)(2), an LR applicant's ER must contain a description of the applicant's plans to modify the facility or its administrative control procedures as described in accordance with § 54.21.

The programs for managing the effects of aging on certain structures and components within the scope of LR at the site are described in the body of the LRA (see Appendix B of the PNPP LRA). The evaluation of structures and components required by 10 CFR 54.21 identified the activities necessary to manage the effects of aging on structures and components during the proposed LR term.

2.5 Employment

The non-outage workforce at the PNPP site consists of approximately 645 persons, including 615 permanent full-time employees and an additional 30 long-term contract workers. Approximately 60 percent of the employees reside in Lake County, Ohio, with approximately

39 percent residing in various other locations within Ohio, and approximately one percent residing in locations in Pennsylvania. Table 2.5-1 summarizes the residential distribution of PNPP staff. There are no plans to add additional permanent employees to support plant operation during the proposed LR operating term, and no LR related refurbishment actives have been identified. Neither are there plans to add additional permanent operation staff to support SMITTR activities during the proposed LR operating term.

During the last five refueling outages, which on average lasted 39 days, there was an average of an additional 1,323 contract employees onsite. Refueling and maintenance outages for PNPP are on a 2-year cycle.

Table 2.5-1 PNPP Permanent Employee Residence Information, February 2022 (Sheet 1 of 2)

State	County	City/Town	Full-Time Employees
Ohio (611)	Ashland (1)	Ashland	1
	Ashtabula (166)	Andover	2
		Ashtabula	49
		Austinburg	8
		Conneaut	16
		Dorset	1
		Geneva	43
		Harpersfield	1
		Hartsgrove	1
		Jefferson	23
		Kingsville	3
		Leroy Township	1
		North Kingsville	1
		Pierpont	2
		Rock Creek	9
		Rome	3
		Saybrook	2
		Unionville	1
	Cuyahoga (20)	Broadview Heights	1
		Chagrin Falls	1
		Cleveland	5
		Euclid	4
		Lakewood	2
		Lyndhurst	2
		Mayfield Heights	3
		Strongsville	1
		Walton Hills	1
	Geauga (35)	Chardon	22
		Huntsburg	4
		Newbury	2
		Novelty	1
		Thompson	6
	Lake (367)	Concord	25
		Eastlake	7
		Fairport Harbor	5
		Kirtland	2
		Leroy	2

Table 2.5-1 PNPP Permanent Employee Residence Information, February 2022 (Sheet 2 of 2)

State	County	City/Town	Full-Time Employees
		Madison	97
		Mentor	80
		Painesville	91
		Perry	35
		Wickliffe	6
		Willoughby	12
		Willowick	5
	Lorain (6)	Avon	2
		Columbia Station	1
		North Ridgeville	2
		Vermilion	1
	Marion (1)	Marion	1
	Medina (1)	Wadsworth	1
	Montgomery (1)	Dayton	1
	Portage (1)	Ravenna	1
	Seneca (1)	Republic	1
	Summit (6)	Akron	1
		Clinton	1
		Northfield	2
		Reminderville	1
		Tallmadge	1
	Trumbull (4)	Cortland	1
		Warren	3
	Wood (1)	Walbridge	1
Pennsylvania (4)	Allegheny (2)	McKeesport	1
		Verona	1
	Crawford (1)	Meadville	1
	Mercer (1)	Greenville	1
		Totals	**615**

(USDOT 2022a)

Note: PNPP employee place of residence is for permanent full-time staff and does not include a breakdown for long-term contract staff, nor temporary refueling outage workers. Long-term contract staff settlement patterns are assumed to generally follow the county settlement patterns indicated by the permanent PNPP staff.

2.6 Alternatives to the Proposed Action

The proposed action as described in Section 2.1 is for the NRC to renew the PNPP OL for an additional 20 years. Because the NRC decision is to renew or not renew the existing PNPP OL, the only fundamental alternative to the proposed action is the no-action alternative, which would result in the NRC not renewing the PNPP OL. In 2020, Ohio was the fourth-largest electricity consumer in the US and ranked among the top 10 states in electricity net generation (EIA 2021a). Ohio's two nuclear plants, PNPP and Davis-Besse, provided 15.5 percent of the total electric power generation in Ohio in November 2021 (EIA 2021a). Because PNPP provides a significant block of long-term baseload capacity in Ohio, it is reasonable to assume that the decision not to renew the PNPP license would involve replacement of its net reliable generation of 1,175 MWe (i.e., 1,277 MWe (net) of generation multiplied by the average capacity factor) to provide power to Energy Harbor's service area. Energy Harbor has considered a range of replacement power alternatives from which to select the alternatives to be further analyzed for replacement of PNPP baseload power generation.

2.6.1 Alternatives Evaluation Process

Energy Harbor developed the following set of evaluation criteria to review PNPP replacement alternatives:

- The purpose of the proposed action (LR) is the continued generation of approximately 1,175 MWe baseload power beyond PNPP's current license term to meet future system generating needs.
- Alternatives evaluated in this ER would need to provide adequate levels of baseload generation for reliable electricity availability for Energy Harbor's service area.
- Alternatives considered must be fully operational by 2026 when PNPP's OL expires, considering development of the technology, permitting, construction of the facilities, and connection to the grid.
- Alternatives must be electricity-generating sources that are technically feasible and commercially viable.
- Technically feasible and commercially viable alternatives with large acreage requirements and/or multiple site requirements must be deployable by 2026 given land acquisition requirements.

Given the criteria requires that a reasonable alternative must be operational by 2026, alternatives with lower land requirements are favored because the process of identifying appropriate site(s), acquiring, or leasing the land, and obtaining various permits and approvals at both the local and state level are time sensitive. The land requirements of solar and wind are driven by their generation capacity factors, 25 percent and 41.4 percent, respectively (EIA 2021a, DOE 2021). The land requirements of some biomass technologies such as energy crops and wood products also require acreage for production of the fuel. Hydropower relying on impoundment can also require hundreds of acres.

2.6.2 Alternatives Considered

Using a screening process based on the above criteria, Energy Harbor considered the full range of alternatives considered in the GEIS in light of the need to meet the criteria.

The following generation sources were selected as reasonable replacement alternatives based on capability to provide reliable baseload power:

- Natural Gas Alternative –
  - Natural gas combustion turbine located onsite
- Renewable and Natural Gas Combination Alternative –
  - Natural gas combustion turbine located onsite
  - Solar panels with lithium-ion battery storage located offsite
  - Wind turbines located offsite

The alternatives selected as reasonable replacement baseload generation alternatives are presented in Section 7.2.1.

Energy Harbor determined the following generating alternatives were not considered reasonable replacements in comparison to renewal of the PNPP OL. Wind and solar are included in the list as unreasonable as discrete alternatives but are components of the renewable and gas combination alternative identified above.

- Purchased power
- Plant reactivation or extended service life
- Conservation and energy efficiency measures
- New nuclear
- Wind
- Solar
- Combination of wind and solar
- Geothermal
- Hydropower
- Biomass
- Fuel cells
- Wave and current energy
- Oil-fired plants
- Coal-fired plants

The alternatives not selected as reliable baseload generation for replacing the PNPP generation are presented in Section 7.2.2.

3.0 AFFECTED ENVIRONMENT

PNPP Unit 1 is owned by Energy Harbor and operated by Energy Harbor Nuclear Corporation and located in Lake County, Ohio, on the southeastern shoreline of Lake Erie. Plant property associated with the site boundary comprises approximately 1,030 acres.

3.1 Location and Features

Located in rural Lake County, Ohio, PNPP is approximately 7 miles northeast of the city of Painesville, the county seat; and approximately 35 miles northeast of the city of Cleveland, the largest populated community in the region (see Table 3.11-1). The eastern two thirds of the site is located within the boundaries of the village of North Perry, while the western third is within Perry Township (TWP). The coordinates for PNPP Unit 1 are latitude 41° 48' 04.2" North and longitude 81° 08' 36.6" West. Figure 3.1-1 shows the PNPP site boundary, facility structures, switchyard, the EAB and industrial area orientation with Lake Erie. At PNPP, a second unit was substantially completed and then construction was formally cancelled in 1994. (EH 2021a). See Section 2.2 for a description of PNPP site facilities and structures. Topographic features adjacent to PNPP and within the site boundary are shown in Figure 3.1-2. (EH 2021a)

3.1.1 Vicinity and Region

The vicinity of PNPP is defined as the area within a 6-mile radius of the Unit 1 reactor center point. As seen in Figure 3.1-3, the PNPP vicinity falls entirely within Lake County, Ohio. Because of overall population size and proximity to nearby urban areas, Lake County falls within the Cleveland-Elyria Metropolitan Statistical Area (MSA) inside the Cleveland-Akron-Canton Combined Statistical Area (CSA) (USCB 2022a). Lake County's population was 232,603 persons in 2020, an increase from 230,041 in 2010 (USCB 2022b).

Perry TWP, where PNPP is located, is one of five townships in Lake County. Perry TWP's 2020 population is 8,862 persons, which is a decrease from 8,999 in 2010. (LC 2022a; USCB 2022c). Table 3.11-1 provides a list communities located within a 50-mile radius of PNPP. The plant falls within the boundary of the village of North Perry which had a 2020 population of 915 persons (population 893 in 2010). Also nearby, the village of Perry is located 3 miles south of PNPP and in 2020 reported a population of 1,602 persons (population 1,663 in 2010). One of the largest cities near PNPP is Painesville with a 2020 population of 20,312 persons, an increase from 19,563 in 2010. (USCB 2022d)

The region of PNPP is defined as the area within a 50-mile radius of the Unit 1 reactor center point. As seen in Figure 3.1-4 and detailed in Table 3.11-2, all, or parts of 10 Ohio counties and three Pennsylvania counties are located within the PNPP region. On the shoreline of Lake Erie, a small portion of Rondeau Provincial Park in Ontario, Canada falls within the PNPP region (Figure 3.1-6). Along with recreational facilities, the park has seasonal camping and lake homes. (OP 2022) According to the demographic analysis discussed in Section 3.11, the PNPP region is considered a high population area. As of 2020, there were 19 Ohio communities within the 50-mile region that have populations of over 25,000 persons, with the cities of Akron and Cleveland having populations of over 100,000 persons (USCB 2022d).

As seen in Figure 3.1-3 and Figure 3.1-4, Lake Erie is the predominate geographic feature in the PNPP region. The site land use is characterized by industrial and wooded areas, while the surrounding vicinity is a mix of small communities with urban and rural residential housing, lands used for agriculture, and dedicated natural areas (see Section 3.2).

The Interstate 90 (I-90) transportation corridor runs northeast-southwest parallel to the Lake Erie shoreline across Ohio and neighboring states and provides transportation access to Lake County and PNPP from the cities and villages in the region. Located approximately one mile south of PNPP, US Highway 20 (US 20) N. Ridge Road (Rd) is a four-lane highway that provides commuter access to the plant from nearby communities via Center Rd and Parmly Rd (see Section 3.9.5). (USDOT 2022a)

Operating Monday through Saturday, the Laketran public transit system offers bus service along the major transportation corridors in Lake County. Laketran also offers a park-n-ride commuter service to downtown Cleveland and dial-a-ride for assisted door-to-door transportation service in Lake County and to select medical facilities in Cuyahoga County. (Laketran 2022)

Freight rail service in Lake County is provided from Norfolk Southern, CSX, and Grand River Railway (LDA 2022a; USDOT 2022a). Within the region, the closest access to Amtrak passenger rail service is at the Cleveland, Ohio station (Amtrak 2022).

Located at the mouth of the Grand River on the southern shore of Lake Erie is Fairport Harbor, a deep draft commercial harbor that handles approximately 1.9 million tons of cargo each year (LDA 2022b). The nearest shipping channel in Lake Erie extends parallel to the shoreline and is located approximately 2 miles from the PNPP center point (EH 2021a).

Within approximately 10 miles of the PNPP center point are eight private airports or heliports: Blackacre Farm Airport (2 miles southwest), JTV Heliport (4 miles east), Woodworth Airport (4.4 miles east), Sky Haven Airport (6.1 miles south southeast), Pheasant Run Airport (6.4 miles south), Associated Enterprises Heliport (9.4 miles southwest), Old Hickory Airpark (10.1 miles east), and Birdland Airport (10.2 miles south). The one public airport located within 10 miles of PNPP is Concord Airpark (9.7 miles south southwest). For commercial passenger air travel, the Cleveland-Hopkins International Airport is located approximately 46 miles southwest of PNPP. (AirNav 2022)

3.1.2 Station Features

The PNPP site occupies approximately 1,030 acres bordering Lake Erie. The terrain associated with PNPP is gently rolling except for the 20-foot to 50-foot bluff at the lake shoreline (EH 2021a)

As seen in Figure 3.1-1, the EAB extends 2,900 feet from the center of the Unit 1 reactor. Control of the EAB, including the mineral rights for oil, gas, and salt, is maintained by EH. Switchyard control is maintained via easement between Energy Harbor and FirstEnergy. (EH 2021a) The acreage of PNPP is subject to certain title exceptions, including what has been granted for public and private uses to various governmental agencies and private entities. This would include the transmission switchyard and Quincy Substation, areas of applicable public roads, road and drainage maintenance, sanitary sewer easements, and gas pipeline easements. Except for Lake Erie and the switchyard, the EAB is completely within the site boundary. An easement has been established with American Transmission Systems, Inc., and Cleveland Electric Illuminating Company to control EAB access within the switchyard.

As shown in Figure 3.1-1, Parmly Rd. traverses the site boundary. Lockwood Rd. has a turnaround within the site boundary. The public portion of Center Rd. crosses the site boundary and intersects with Parmly Rd. The PNPP entrance is on Center Rd. north of the Parmly Rd. intersection. Those portions of Center Rd. and Lockwood Rd. within the EAB have been withdrawn from public use, and signage has been posted along these roads to discourage public access. No public road traverses the EAB. PNPP previously had an onsite rail spur connection to the nearby Norfolk Southern freight rail system. However, approximately 290 feet of this spur have been removed or paved over, and the spur is no longer in use. Major equipment is now brought to the site via crawler tractors and oversized trailers. (EH 2021a; USDOT 2022a)

Authority to control all activities in the Lake Erie portion of the exclusion area is provided by the United States Coast Guard. Activity within the EAB that is unrelated to plant operation can be expected from fishing boats and other pleasure craft. A public address system has been installed for plant communication to individuals in areas within the EAB including the beach and Lake Erie. (EH 2021a)

PNPP controls the mineral rights, both within the EAB on land and within 1,800 feet of all safety-related structures in Lake Erie, with the exception of the mineral rights within the switchyard. These rights are being pursued via easement. (EH 2021a) As described in Section 3.2, PNPP has a non-extraction lease agreement with the state of Ohio that expires in May 2072. The non-extraction lease prevents the mining of halite resources in the submerged area extending from the PNPP shoreline into Lake Erie. In addition, a submerged land lease with the state of Ohio is currently in place for approximately 3,500 feet of existing shoreline protection features and expires in May 2072. This submerged land lease includes the intake and discharge tunnels.

There are no residences within the site boundary. The nearest residence to PNPP is 0.9 miles northeast of the plant (EH 2021b).

3.1.3 Federal, Native American, State, and Local Lands

As shown in Figures 3.1-5 and 3.1-6, there are a variety of national, state, and local parks, and recreational and wildlife management areas located in the PNPP 50-mile region. As identified in Table 3.1-1, there are 19 publicly managed lands found within the 6-mile vicinity of PNPP, all in Lake County. A discussion of outdoor recreational opportunities located in the vicinity of PNPP is found in Section 3.9.7. There are no public parks located within the PNPP site boundary, nor Lake Erie accessible recreational facilities.

There are no federal or state recognized native American Indian tribes with reservations or identified lands located within the PNPP 50-mile region (NCSL 2022; USCB 2022e). There are two Ohio military installations located within the PNPP region, including the Camp James A. Garfield Joint Military Training Center and the Youngstown Air Reserve Station (USDA 2022a; USDOT 2022a).

3.1.4 Federal and Non-Federal Related Project Activities

There is one potential future PNPP shoreline protection project under discussion. It is proposed to add shoreline protection to arrest continued erosion along the currently unprotected northeast shoreline of Lake Erie within the site boundary. The project area would start where the existing installed shoreline protection features stop north of the cooling tower and extend east approximately 1,200 feet approaching the eastern lakeshore property line. Evaluation of project options is ongoing, and a final design has not been selected (use of sheet piling, armor stone revetment, etc.). Currently the potential project is funded for 2023 (mainly design/permitting) and tentatively scheduled to be installed in 2024.

The ISFSI and the spent fuel pool are sized to accommodate all spent nuclear fuel generated through the period of extended operation (PEO). Consequently, ISFSI expansion is not expected during the license renewal term. However, if expansion occurred, it would likely be on already disturbed land.

In 2020 the village of North Perry focused on an erosion control effort to protect the community's Lake Erie shoreline. In 2021, the village began the process of mitigating the effects of severe erosion on the northern side of Village Hall and hired a contractor to perform revetment work on a bluff overlooking Lake Erie. The village of North Perry has also been reviewing a variety of proposals to make modifications to the harbor at the Townline Park marina and address issues of littoral drift. A sediment mitigation study at the marina is being undertaken to evaluate strategies and potential impacts to both public and private property. Because of Lake Erie shoreline erosion issues, North Perry and 12 other Lake County communities approved legislation to be part of a Shoreline Special Improvement District to help residents who own property along Lake Erie secure special financing to complete erosion-control projects.

In 2021, Perry TWP began an erosion control project on the Lake Erie shoreline to fortify a severely eroded bluff located in Perry Township Park behind the historic Parmly Mansion. Over the years Perry TWP has undertaken a series of these types of shoreline protection projects at Perry Township Park.

Ohio's Statewide Transportation Improvement Program (STIP) for 2021-2024 lists several proposed highway projects for Lake County. One identified 2022 STIP project located within Perry TWP south of PNPP is described as a major rehabilitation of US 20/N. Ridge Rd involving minor widening and drainage replacement. A number of side streets located in the US 20/N. Ridge Rd project area, including Center Rd, will continue to remain open during the construction period. Currently construction will take place in three segments and is scheduled to begin Spring 2023 and end Fall 2025. (ODOT 2022a; ODOT 2022b)

Table 3.1-1 Federal, State, and Local Lands[a] Totally or Partially within a 6-Mile Radius of PNPP (Lake County)

Name	Type
Blair Landing	Local
Blair Ridge Park	Local
Dana's Park	Local
Farm and Ranch Lands Protection Program (Natural Resources Conservation Service)	Federal
Grand Wild and Scenic River (Ohio designation)	State
Indian Point Park	Local
Kimball's Woods	State
Lake Erie Bluffs	Local
Lake Erie Coastal Ohio Trail (Scenic Byway)	Federal
Lakeshore Reservation	Local
Lee Lydic Park	Local
Mason's Landing Park	Local
North Perry Park	Local
North Townline Park	Local
Paine Falls Park	Local
Painesville Township Park	Local
Perry Township Park (Parmly)	Local
River Road Park	Local
Wetlands Reserve Program (Natural Resources Conservation Service)	Federal

(LMP 2022a; ODNR 2022a; OH 2022; PT 2022a; USDA 2022a)

a. Table list is based on available public information and includes lands totally or partially located within a 6-mile radius of PNPP.

Figure 3.1-1 PNPP Plant Layout

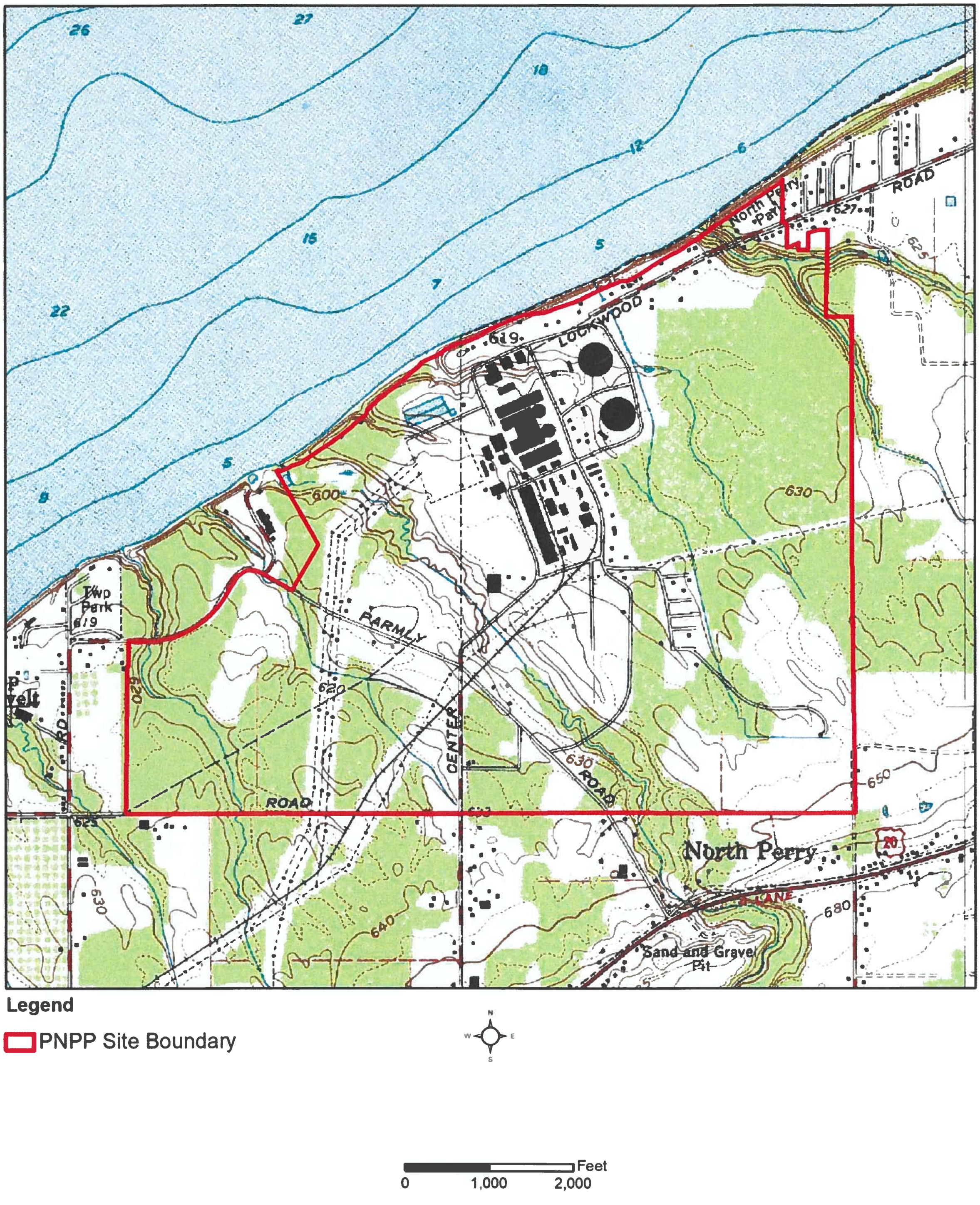


Figure 3.1-2 PNPP Area Topography

Legend

- Community
- Interstate
- U.S. Route
- State Highway
- Local Road
- Railroad
- Airport
- Heliport
- Surface Water
- PNPP Site Boundary
- 6-Mile Radius
- County
- Place

Miles 0 1 2

Figure 3.1-3 PNPP Site and 6-Mile Radius

Figure 3.1-4 PNPP Site and 50-Mile Radius

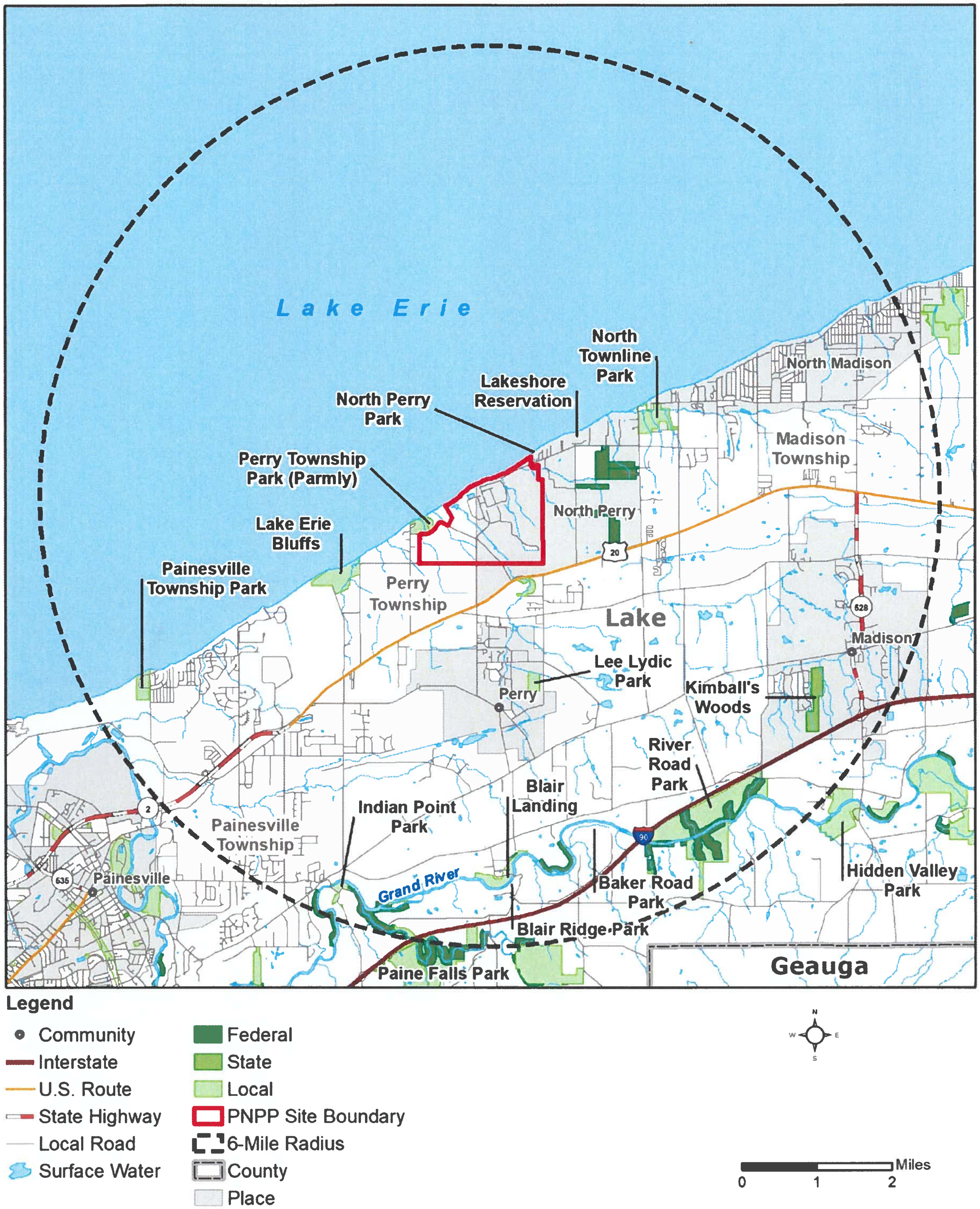


Figure 3.1-5 Federal, State, and Local Lands within a 6-Mile Radius of PNPP

Figure 3.1-6 Federal, State, and Local Lands within a 50-Mile Radius of PNPP

3.2 Land Use and Visual Resources

Land use descriptions focus on Lake County, Ohio because, as described in Section 2.5, approximately 60 percent of PNPP's permanent workforce reside in this county, and North Perry Village, where the power generating portion of the site is located.

3.2.1 Onsite Land Use

As described in Section 3.1, PNPP is located on the shores of Lake Erie in northern Lake County, Ohio. The eastern two thirds of the site, including Unit 1 and associate power generating facilities, is located within the boundaries of the village of North Perry, and the western third is within the boundaries of Perry TWP.

The PNPP site is situated on approximately 1,030 acres, with the major plant facilities (Unit 1 and related structures, cooling towers, switchyard, and other associated structures) occupying approximately 250 acres of the site. The remaining acreage is generally characterized by forested areas and grasslands.

As shown in Table 3.2-1 and illustrated in Figure 3.2-1, deciduous forest is the largest land use/land cover category within the PNPP site boundary, covering approximately 58.1 percent of the site. Developed (open space/low/medium/high intensity) categories collectively are the next largest land use/land cover categories accounting for approximately 24.7 percent of the site, followed by grassland/herbaceous and woody wetland categories with 9.1 and 3 percent, respectively. The remaining five land use/land cover categories account for approximately 5 percent of the site. (MRLC 2021)

The portion of the PNPP site within the boundaries of the village of North Perry, which includes the power generating and associated facilities, is zoned as a General Industrial District (I-2) according to the North Perry Village Planning and Zoning Code. This district accommodates industrial activities that have a generally clean character, and which normally generate only limited outdoor activities that are clean, quiet, and free of hazardous or objectionable elements such as noise, odor, smoke, contaminants, and glare. (NPV 2022a) The remainder, mostly undeveloped and forested portion of the site is zoned as a Heavy Industrial District (I-3) by Perry Township Zoning Resolution, and allows for manufacturing, assembly, processing, storage, and similar industrial operations that may require outdoor storage of products or raw materials and may generate significant volumes of heavy vehicular traffic (PT 2022b).

The PNPP site boundary is comprised of several property parcels and landowners. As described in Section 3.1, Energy Harbor owns and controls the land and mineral rights within the EAB, except for the switchyard. The switchyard and Quincy Substation are owned by subsidiaries of FirstEnergy (LN 2022). An approximately 0.11-acre parcel, which is owned and used by Lake County for a sewer pump station, is located within southern portions of the site and is included as part of the site boundary. As discussed in Section 3.1, acreage of the PNPP site boundary is also subject to certain title exceptions, including rights-of-ways and easements granted for public and private uses to various governmental agencies and private entities. Energy Harbor has a non-extraction lease with the State of Ohio that prevents the extraction of the mineral halite within an approximately 410-acre submerged land parcel extending from the shore into Lake Erie. In addition, a submerged land lease with the State is in place that covers approximately 3,500 feet of existing shoreline protection along the lake front as well as the intake and discharge tunnels which extend out and under the lake. Both leases were renewed in 2022 for a 50-year term that expires May 14, 2072.

3.2.2 Offsite Land Use

As described in Section 3.11.1 and listed in Table 3.11-2, Lake County has seen an increase in total population between 2010 and 2020, but the overall trend for the county is a decrease in population through 2050.

As described in Section 3.1, the vicinity (6-mile radius) surrounding PNPP is a mixture of towns, residential development, and agricultural lands with forested and natural areas interspersed. The land use/land cover categories located within the vicinity of PNPP are illustrated in Figure 3.2-2. Lake Erie is the predominate natural feature in the vicinity, and as noted in Table 3.2-2, open water is the largest land use/land cover category at approximately 49.4 percent. The next largest land use/land cover categories are developed areas (open space/low/medium/high intensity) and deciduous forest which represent 17.1 and 17.0 percent respectively, followed by pasture/hay at 11.8 percent. The remaining eight land use/land cover categories account for approximately 4.7 percent of the vicinity. (MRLC 2021)

Lake County occupies approximately 146,731 acres of land, of which 13,098 acres (approximately 8.9 percent) are proportioned to farmland. The 2017 Census of Agriculture reports that the county had a total of 214 farms, with an average farm size of 61 acres. Approximately 171 farms produce crops, with the primary crops reported as forage (1,581 acres), soybeans (753 acres), orchards (173 acres), wheat for grain (38 acres), and potatoes (5 acres). Livestock is also an important product in the county, with livestock commodities such as layers (30 farms), cattle and calves (24 farms), sheep and lambs (19 farms), hogs and pigs (six farms), and broilers and other meat-type chickens (three farms). Other agricultural uses of farmland within the county include woodlands (103 farms; 2,556 acres), pastureland (80 farms; 776 acres), and permanent pasture and rangeland (76 farms; 666 acres). (USDA 2022b)

Ohio Revised Code (ORC) Chapter 713, Planning Commissions, provides for the creation of planning commissions at various levels of government and the implementation of plans and development regulations. At the county level, Section 713.22 of the ORC allows county commissioners to create a county planning commission to oversee rules and regulations governing plats and subdivision of land within unincorporated areas (ORC 711) and to play an advisory role by provide planning assistance to other units of local governments, council of governments, planning commissions, and joint planning commissions. (CCAO 2022; Justia 2022). At the municipal and village level, Sections 713.02, 713.12 and 711.09 of the ORC provides for the development of a municipal planning commission with the authority to make comprehensive plans and maps, and for municipal corporations to create and enact zoning regulations that guide current and future development and improvement for the whole or any portion of the municipal corporation, and of any land outside thereof which is related to the planning of the municipal corporation. (Justia 2022; NPV 2022a)

The Lake County Board of Commissioners first organized the Lake County Planning Commission (the Commission) as an advisory board from 1927 to 1931. After a period of dormancy, the Commission was reactivated in 1956 as a planning commission. In 2012, the Commission was merged with the county's Federal Grant Office to form the Lake County Office of Planning and Community Development (the Commission). In respect to planning, the role of the Commission is to oversee the subdivision of land through the Lake County Subdivision Regulations resolution and to provide planning and zoning services to the five unincorporated townships within Lake County: Concord, Leroy, Madison, Painesville, and Perry. Specific planning services include providing topographic maps, census information, land use data, zoning information, comprehensive plan information, aerial photographs, subdivision and lot split activity in the townships, wetland maps, housing numbers for most townships, and coastal erosion maps. The Commission also administers funds received from the U.S. Department of Housing and Urban Development through their Community Development Block Grant program to support housing programs, economic development projects, public improvement, and public services within the county and townships. (LC 2022b)

The North Perry Comprehensive Plan (the plan) serves as the chief planning tool to guide and manage growth, development, and the built and natural environment of North Perry. A primary focus of the plan is to implement land use policies that protect natural resources, sustain a viable nursery industry and related agritourism, ensure new development is carefully integrated into a semi-rural agrarian landscape, mandate high aesthetic standards and high-quality appearance of public spaces, support sustainable economic development, and promote innovative and sound planning practices. For many years, North Perry was primarily an agricultural community, and a regional center of the nursery industry. However, over the past several decades land use patterns have changed dramatically. The largest change was the construction of PNPP and the associated site boundary which occupies approximately 45 percent of the land area in the village. Additional development, including the current patterns of housing developments along collector roads and scattered commercial and small light industrial businesses along North Ridge Rd, could impact the village's remaining semi-rural identity and sense of place. The major issues facing North Perry include accommodating new growth while maintaining a semi-rural character, keeping the nursery industry viable, and promoting high-quality development that will create a distinctive sense of place. The plan provides policy guidance for addressing future issues including housing, land use, urban design and community appearance, agricultural preservation, transportation, housing, community facilities, parks, economic development, utilities, and natural resources. The plan is implemented through the North Perry Village Planning and Zoning Code, subdivision regulations, and other land use regulations, as well as through decisions made by the North Perry Village Council, Planning Commission, and various subcommittees related to planning and development. (NPV 2022b)

3.2.3 Visual Resources

As discussed in Section 3.1, PNPP is located on the southeastern shoreline of Lake Erie and within the boundaries of the village of North Perry in Lake County, Ohio. Figure 3.1-1 shows the PNPP site layout and site boundary in association with Lake Erie. The surrounding area is a mixture of rural residential, towns and small communities, agricultural land, deciduous forest, and lakeshore frontage. The nearest residence is 0.9 miles northeast of the plant (EH 2021a).

Predominant visual features at PNPP include the cooling towers, meteorological tower, reactor domes, and associated turbine buildings. The two hyperbolic cooling towers are the tallest and most visible features at the site with a height of approximately 516 feet each (EH 2021a). Forested areas onsite and in the surrounding areas provides some visual screening, but the cooling towers are visible from portions of US 20 to the south, along portions of Antioch and Lockwood roads at the eastern boundary and northeast corner of the site, and from Perry Township Park to the west. The facility structures are also visible along portions of Parmly and Center roads as they traverse through the central and western portions of the site, and from the open waters of Lake Erie. There are no plans for refurbishment that would create new visual impacts during the proposed LR operating term. Therefore, PNPP would continue to have minimal visual impact on neighboring residential areas and communities.

Table 3.2-1 Land Use/Land Cover, PNPP Site

Category	Acres[(a)]	Percentage
Open Water	12.9	1.3
Developed, Open Space	41.4	4.0
Developed, Low Intensity	57.4	5.6
Developed, Medium Intensity	58.9	5.8
Developed, High Intensity	95.6	9.3
Deciduous Forest	594.7	58.1
Mixed Forest	8.2	0.8
Shrub/Scrub	10.2	1.0
Grassland/Herbaceous	92.7	9.1
Hay/Pasture	17.8	1.7
Woody Wetlands	30.5	3.0
Emergent Herbaceous Wetlands	2.9	0.3
Total	1,023.2	100

(MRLC 2021)

a. The acreages presented in this table are based on the Multi-Resolution Land Characteristics Consortium land use/land cover data. These data are presented in a raster (pixel-based) format and because of their square geography, they do not exactly match the PNPP site boundary. This geographic variation creates a small difference between total acreages reported in Table 3.2-1 compared to the PNPP site acreage reported throughout the ER.

Table 3.2-2 Land Use/Land Cover, 6-Mile Radius of PNPP

Category	Acres	Percentage
Open Water	35,801.1	49.4
Developed, Open Space	3,480.0	4.8
Developed, Low Intensity	6,405.2	8.8
Developed, Medium Intensity	2,048.9	2.8
Developed, High Intensity	499.7	0.7
Barren Land	144.8	0.2
Deciduous Forest	12,294.2	17.0
Evergreen Forest	16.5	0.02
Mixed Forest	815.5	1.1
Shrub/Scrub	183.9	0.3
Grassland/Herbaceous	1,085.3	1.5
Hay/Pasture	8,513.3	11.8
Cultivated Crops	316.9	0.4
Woody Wetlands	789.1	1.1
Emergent Herbaceous Wetlands	42.5	0.1
Total	72,436.9	100

(MRLC 2021)

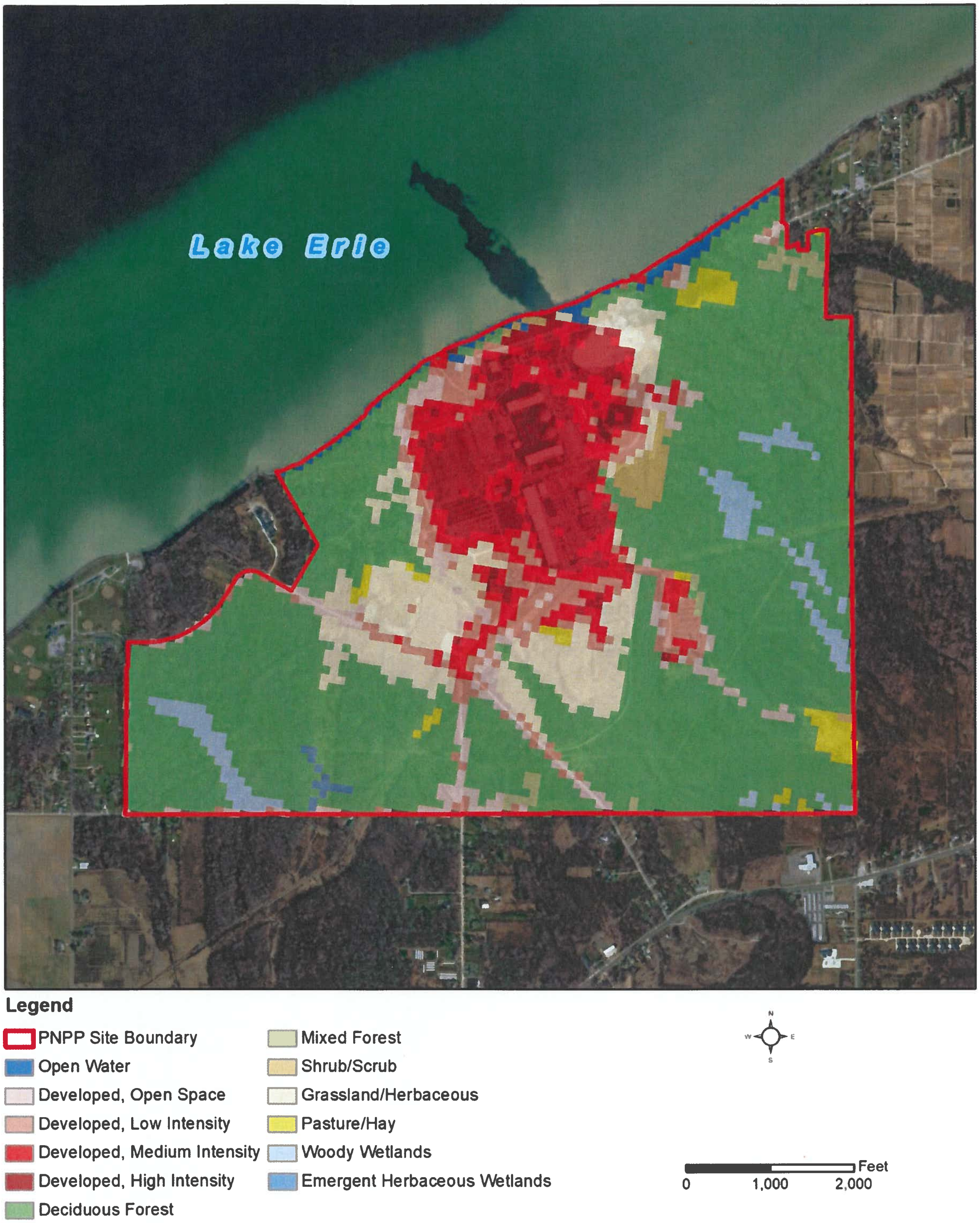


Figure 3.2-1 Land Use/Land Cover, PNPP Site

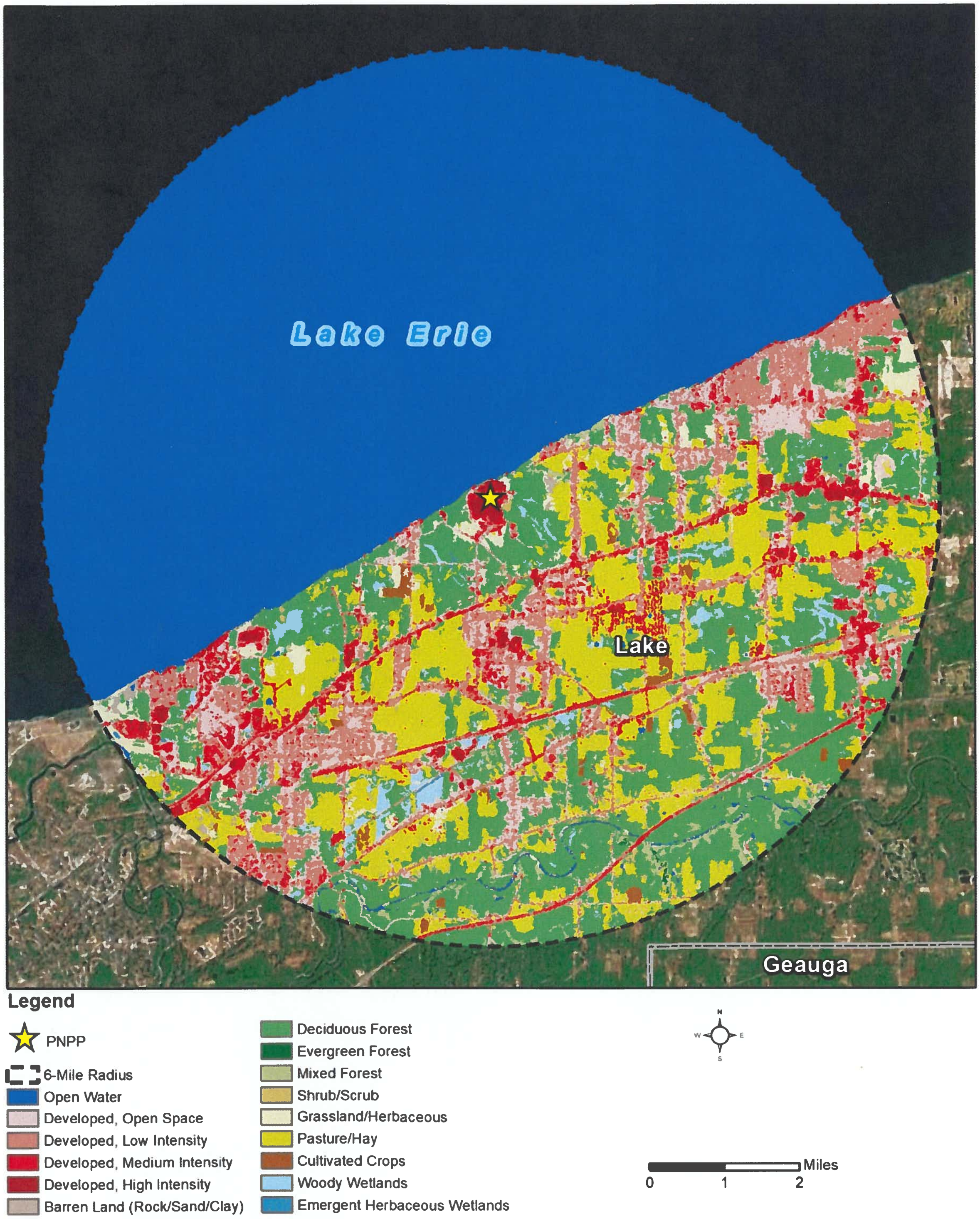


Figure 3.2-2 Land Use/Land Cover, 6-Mile Radius of PNPP

3.3 Meteorology and Air Quality

The PNPP site is located on the southeastern shore of Lake Erie. The eastern two thirds of the site is within the boundaries of the village of North Perry, Ohio while the western third is within Perry TWP, Ohio. A high-level overview of the plant layout is provided in Figure 3.1-1.

Climatological data presented below have been provided to represent a range of meteorological conditions considered typical for the PNPP site region. The Cleveland, Ohio (KCLE) weather station is the closest first-order NWS data collection station to PNPP with a significant period of meteorological data, and thus has been used to describe the representative climatic conditions. The Erie, Pennsylvania (KERI) weather station, also a first-order NWS data collection station with a significant period of meteorological data, falls along the coast of Lake Erie. The PNPP site falls on the coast of Lake Erie between both weather stations, thus making both appropriate for comparison. (NCDC 2022a)

3.3.1 General Climate

The Cleveland, Ohio (KCLE) weather station is located on the Cleveland Hopkins International Airport (NCDC 2022b). The station is approximately 5 miles south of Lake Erie on the west side of the city in northeastern Ohio. The surrounding terrain is generally level except for an abrupt ridge on the eastern edge of the city which rises some 500 feet above the shore terrain. (NCDC 2022a) The local climate is continental in character modified by influences from Lake Erie. West to northerly winds blowing off Lake Erie tend to lower daily high temperatures in summer and raise temperatures in winter. Temperatures observed at the Hopkins International Airport average two to four degrees Fahrenheit (°F) higher than temperatures observed at the lakeshore in summer, while overnight low temperatures average two to four degrees Fahrenheit lower at the airport than the temperatures at the lakefront during all seasons. Summers are moderately warm and humid with occasional days with temperatures that exceed 90°F. Winters are relatively cold and cloudy with an average of five days of sub-zero temperatures. Temperatures of 100°F or higher are rare. Annual extremes in temperature normally occur soon after late June and December. On average, freezing temperatures in fall are first recorded in October while the last freezing temperature in spring normally occurs in April. (NCDC 2022a) As is characteristic of continental climates, precipitation varies widely from year to year. However, it is well distributed throughout the year with spring being the wettest season. Thunderstorms are most frequent from April through August. Mean annual snowfall increases from west to east in Cuyahoga County ranging from about 45 inches in the west to more than 90 inches in the extreme east. (NCDC 2022a)

The Erie, Pennsylvania (KERI) meteorological observations are made at Erie International Airport, which is 6 miles southwest of the center of Erie, Pennsylvania and approximately 1 mile from the shore of Lake Erie. The terrain rises gradually in a series of ridges paralleling the shoreline. The elevation rises to 500 feet above the lake elevation three to 4 miles inland then to 1,000 feet above the lake elevation at approximately 15 miles inland. (NCDC 2022a) During the winter months, the many cold air masses moving south from Canada are modified by the relatively warm waters of Lake Erie. However, the temperature difference between air and water produces an excess of cloudiness and frequent snow from November through March. Snowfall from instability showers moving southward off the lake usually increases due to the upslope terrain. Snowfall is somewhat higher south of the city than along the lake shore. Spring weather is quite variable in Erie, but generally cloudy and cool. Proximity to the lake frequently prevents killing frosts that occur inland. Summer heat waves are tempered by cool lake breezes that may reach several miles inland, and days with temperatures above 90°F are infrequent. Autumn, with long dry periods and an abundance of sunshine, is usually the most pleasant period of the year in Erie. (NCDC 2022a) Precipitation is well distributed throughout the year, although the number of days with measurable amounts varies considerably from a low average of about one day in three for the period June through September to about one-half of the days from November through March, when snow flurries and squalls move in from the lake. (NCDC 2022a)

The PNPP site is located in northeast Ohio on the south shore of Lake Erie, approximately midway between Cleveland, Ohio and Erie, Pennsylvania near Painesville, Ohio. The terrain is generally flat with rolling hills. Detailed meteorological information for PNPP, is described in Section 3.3.2. The climate in the region of the PNPP site is continental in character, moderated somewhat due to the proximity of Lake Erie. West through northerly surface winds from Lake Erie have a moderating effect on surface temperatures tending to lower daily maximum temperatures in the summer and increase temperatures and cloudiness during the winter. The presence of the lake has little effect on local conditions when winds are from other than these directions.

3.3.2 Meteorology

The climatological conditions for the PNPP region and site were evaluated when the plant began operations and presented in the UFSAR. For the proposed LR of PNPP, Energy Harbor completed a review of the most recent meteorological information available from public sources and from PNPP monitoring to confirm that the conclusions of the previous review remains valid. The hourly meteorological data for PNPP was collected from January 1, 1992, through December 31, 2021. A full 30 years of data from the site was evaluated. A summary of Energy Harbor evaluation is provided below.

3.3.2.1 Wind Direction and Speed

As illustrated in Figure 3.3-1, the prevailing wind direction at the PNPP site is from the south-southwest. In winter and spring, the prevailing wind at the PNPP site is from the west south-west (see Figures 3.3-2 and 3.3-3). During summer and fall the prevailing wind direction is from the south-southwest (see Figures 3.3-4 and 3.3-5). The average wind speed for the past five years is 6.2 miles per hour (mph) which is lower than the 37-year average of 9.6 mph at Cleveland (KCLE) and the 37-year average of 10.0 mph at Erie (KERI) Bay (NCDC 2022a)

For Cleveland (KCLE), the 37-year period of record data shows the annual prevailing wind direction (i.e., the direction from which the wind blows most often) is from 240 degrees (i.e., from the west-southwest). Monthly prevailing winds are from the west-southwest during the winter. During spring, the wind direction is from the north-northeast and south-southwest. In the summer and fall, the mean prevailing wind is from the south-southwest and southwest. As listed in Table 3.3-1, the mean wind speed over the past 37-year period of record was 9.6 mph. A maximum three-second wind speed of 72 mph was recorded in November of 2020 at Cleveland (KCLE). (NCDC 2022a)

For Erie (KERI), the 37-year period of record data shows the annual prevailing wind direction (i.e., the direction from which the wind blows most often) is from 190 degrees (i.e., from the south). Monthly prevailing winds are from the south-southwest and west during the winter. During spring, the wind direction is from the west, northeast and south. In the summer and fall, the mean prevailing wind is from the south. As listed in Table 3.3-1, the mean wind speed over the past 37-year period of record was 10.0 mph. A maximum three-second wind speed of 68 mph was recorded in January of 2017 at Erie (KERI). (NCDC 2022a)

Mean monthly wind speeds at the PNPP site are provided in Table 3.2-2, based on a 30-year record of measurements from the onsite meteorological monitoring system, lower level (32.8 feet above ground level). The average wind speed on an annual basis was 7.0 mph, indicating the site wind speeds are lower than both Cleveland (KCLE) and Erie (KERI). The onsite monitoring data indicate the wind at PNPP is from the south-southwest for a significant period of time (especially during August through December), and from the west and west-southwest (January through July). Seasonal wind rose diagrams for the period 2017-2021 are provided in Figure 3.3-1, Figure 3.3-2, Figure 3.3-3, Figure 3.3-4, and Figure 3.3-5.

3.3.2.2 Temperature

Representative regional temperature averages and extremes are available from the Cleveland (KCLE) monitoring station. The local climate data summary for the Cleveland (KCLE) area indicates that the mean daily maximum temperature is highest during July 81.3°F and decreases to the seasonal low in January (34.4°F). The Cleveland (KCLE) area experiences normal temperatures above 90°F approximately 9.0 days per year in May through September. The highest temperature of record (104°F) occurred in June 1988. The mean daily minimum temperature is above 50°F in June, July, August, and September and is at its lowest in February, when the mean daily minimum decreases to 20.1°F. Record low temperatures less than 0°F have been recorded in January, February, March, and December with below freezing temperatures approximately 104.3 days per year normally occurring in every month except June, July, August, and September. The lowest temperature of record by the Cleveland (KCLE) station is -20°F, occurring in January 1994. (NCDC 2022a) Monthly and annual daily mean temperature data and temperature extremes for the Cleveland (KCLE) area are summarized in Table 3.3-3.

Representative regional temperature averages and extremes are available from the Erie (KERI) monitoring station. The local climate data summary for the Erie (KERI) area indicates that the mean daily maximum temperature is highest during July (79.8°F) and decreases to the seasonal low in January (33.7°F). The Erie (KERI) area experiences normal temperatures above 90°F approximately 2.6 days per year in May through September. The highest temperature of record (100°F) occurred in June 1988. The mean daily minimum temperature is above 50°F in June, July, August, and September and is at its lowest in February, when the mean daily minimum decreases to 19.7°F. Record low temperatures less than 0°F have been recorded in January, February, March, and December with below freezing temperatures approximately 113.2 days per year normally occurring in every month except June, July, August, and September. The lowest temperature of record by the Erie (KERI) station is -18°F, occurring in February 2015. (NCDC 2022a) Monthly and annual daily mean temperature data and temperature extremes for the Erie (KERI) area are summarized in Table 3.3-3.

Average temperatures in the area of PNPP range from 28.3°F in January to 71.6°F in July, with annual extremes of approximately -17.9°F low and 95.9°F high. Monthly and annual daily mean temperature data and temperature extremes for the PNPP area are summarized in Table 3.3-4. The 5-year average for PNPP (51.7°F) is higher than the 30-year annual average of 50.5°F. Both values fall between the annual mean daily minimum (41.9°F) and the annual mean daily maximum (58.2°F) for Cleveland (KCLE) and the annual mean daily minimum (41.6°F) and the annual mean daily maximum (56.8°F) for Erie (KERI). (NCDC 2022a).

3.3.2.3 Precipitation

The precipitation records of normal rainfall totals for the Cleveland (KCLE) area indicate that precipitation of 0.01 inches or more occurs on average for 154.9 days per year, with 9.8 on average days per month receiving at least some precipitation. As listed in Table 3.3-5, the annual average precipitation at the Cleveland (KCLE) station is 39.14 inches per year. Precipitation recorded at the station is evenly dispersed ranging from 2.34 inches in February to 3.81 inches in September. Seasonally, the winter months have the lowest amount of precipitation (approximately 20.9 percent) while the rest of the seasons have similar amounts of precipitation (25.8, 26.6 and 26.8 percent). The lowest monthly precipitation occurs in February while the highest monthly precipitation occurs in September. The maximum 24-hour precipitation total recorded at Cleveland (KCLE), 5.24 inches, occurred in September 1996. Cleveland (KCLE) received a record minimum monthly rainfall total (0.36 inches) in January 1961. (NCDC 2022a)

The precipitation records of normal rainfall totals for the Erie (KERI) area indicate that precipitation of 0.01 inches or more occurs on average for 166.4 days per year, with 10.2 on average days per month receiving at least some precipitation. The annual average precipitation at the Erie (KERI) station is 42.16 inches per year. Precipitation recorded at the station is evenly dispersed ranging from 2.39 inches in February to 4.61 inches in September. Seasonally the winter months have the lowest amount of precipitation (approximately 21.54 percent) while the rest of the seasons have similar amounts of precipitation (23.06, 25.55 and 29.86 percent). The lowest monthly precipitation occurs in February while the highest monthly precipitation occurs in September. The maximum 24-hour precipitation total recorded at Erie (KERI), 6.11 inches, occurred in September 1979. Erie (KERI) received a record minimum monthly rainfall total (0.50 inches) in August 2002. (NCDC 2022a)

The average annual precipitation at PNPP is 38.8 inches which is less than both Cleveland (KCLE) and Erie (KERI). Precipitation recorded at the PNPP site is cyclic with lowest amount occurring during the winter months then peaking in October. There is a steep drop in precipitation over the four months between October to February then a more gradual increase in precipitation over eight months between February and October. The precipitation pattern is similar to the precipitation patterns found at Cleveland (KCLE) and Erie (KERI) where the same trend occurs around February and September. For PNPP, the maximum monthly precipitation of 12.9 inches was recorded in July of 2006. The minimum amount of precipitation recorded at PNPP was 0.6 inches in February 1999. Monthly and annual precipitation data and precipitation extremes for the PNPP area are summarized in Table 3.3-6.

3.3.2.4 Snow and Glaze

In the Cleveland (KCLE) area, temperatures go below freezing 104.3 days per year. Cleveland (KCLE) normally receives 68.1 inches of snow per year, with 20.6 days per year receiving at least one inch or more of snowfall. The largest snowfall in a 24-hour period, 16.0 inches, occurred in March 1987. Since 1992, annual snowfall has ranged from as little as 32.8 inches to 117.9 inches. (NCDC 2022a) Similar to Cleveland (KCLE), temperatures at the PNPP site go below freezing 100.4 days per year. Snowfall at the site is not recorded by PNPP.

In the Erie (KERI) area, temperatures go below freezing 113.2 days per year. Erie (KERI) normally receives 100.9 inches of snow per year, with 27.7 days per year receiving at least one inch or more of snowfall. The largest snowfall in a 24-hour period, 23.0 inches, occurred in November 1956. Since 1992, annual snowfall has ranged from as little as 46.9 inches to 166.3 inches. (NCDC 2022a)

3.3.2.5 Relative Humidity and Fog

The closest available fog data for the PNPP region are from the NWS observation station at the Cleveland Hopkins International Airport (KCLE). The local climatological data for Cleveland (KCLE) indicate an average of 11.8 days per year of heavy fog. The Erie (KERI) area averages 16.2 days per year of heavy fog. Fog at the site is not recorded by PNPP. Heavy fog is defined by the NWS as fog which reduces visibility to 0.25 miles or less. (NCDC 2022a)

3.3.2.6 Severe Weather

3.3.2.6.1 Thunderstorms

For the Cleveland (KCLE) area, thunderstorms are most frequent during the late spring, summer, and early fall months, with the greatest occurrence during the months of June and July. The Erie (KERI) area has the same trend with the greatest occurrence during June, July, and August. The mean number of days with thunderstorms in each month for Cleveland (KCLE) and Erie (KERI) are provided in Table 3.3-7. Based on the National Centers for Environmental Information (NCEI) records, Lake County, Ohio, has recorded 160 significant thunderstorm events since 1960 with most of the thunderstorms occurring in June and July. (NCEI 2022)

3.3.2.6.2 Tornados

Based on NCEI records, a total of two tornadoes have been recorded in Lake County, Ohio since 1960. The records show that the intensity of the storms was limited to a Category F0 in 1969, and a Category F2 in 2000. (NCEI 2022)

3.3.2.6.3 Hurricanes

The NCEI does not have any record of a hurricane in Lake County, Ohio. (NOAA 2022a)

3.3.2.7 Atmospheric Stability

Atmospheric stability is a meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined by the difference in temperature between two heights. A seven-category atmospheric stability classification scheme (ranging from A for extremely unstable to G for extremely stable) based on temperature differences is set forth in the NRC's Regulatory Guide 1.23, Revision 1 (NRC 2007). When the temperature decreases rapidly with height (typically during the day when the sun is heating the ground), the atmosphere is unstable and atmospheric dispersion is greater. Conversely, when temperature increases with height (typically during the night as a result of the radiative cooling of the ground), the atmosphere is stable, and dispersion is more limited. The stability category between unstable and stable conditions is D (neutral), which would occur typically with higher wind speeds and/or higher cloud cover, irrespective of day or night. (NRC 2013c).

Based on a five-year average (2017-2021), onsite temperature difference data recorded at PNPP indicate that stable atmospheric conditions (E to G) occurred about 31.7 percent of the time and unstable conditions (A to C) occurred about 33.1 percent of the time. The remaining observations (about 35.2 percent) fell into the neutral (D) category. Stability class distributions at PNPP covering the period 2017-2021 are presented in Table 3.3-8.

3.3.3 Air Quality

3.3.3.1 Clean Air Act Nonattainment Maintenance Areas

The Clean Air Act (CAA) was established in 1970 [42 USC § 7401 et seq.] to reduce air pollution nationwide. The EPA has developed primary and secondary national ambient air quality standards (NAAQS) under the provisions of the CAA. The EPA classifies air quality within an air quality control region (AQCR) according to whether the region meets or exceeds federal primary and secondary NAAQS. An AQCR or a portion of an AQCR may be classified as being in attainment or non-attainment, or it may be unclassified for each of the six criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM-2.5, fine particulates; and PM-10, coarse particulates), ozone, and sulfur dioxide (SO_2).

Emissions from non-radiological air pollution sources, including the criteria pollutants, are controlled through compliance with federal, state, and local regulations. Nonattainment areas are areas where the ambient levels of criteria air pollutants in the air are designated as not meeting the air quality standard set forth in federal, state, and local regulations. Attainment areas are areas that meet the air quality standard or cannot be classified (depending on the pollutant and other factors). A maintenance area is an area that formerly did not exceed the NAAQS criteria but currently exceeds the NAAQS criteria. (EPA 2022b)

There are no Class I Federal areas, in which visibility is an important value, as designated in 40 CFR, Part 81, Subpart D, in Ohio or Pennsylvania. (40 CFR, Part 81, Subpart D)

The PNPP 62-mile region falls within four Intrastate AQCRs. The AQCRs are the Greater Metropolitan Cleveland Intrastate Air Quality Control Region (40 CFR 81.22), the Steubenville-Weirton-Wheeling Interstate Air Quality Control Region (40 CFR 81.33), the Northwest Pennsylvania-Youngstown Interstate Air Quality Control Region (40 CFR 81.74), and the Mansfield-Marion Intrastate Air Quality Control Region (40 CFR 81.201). Two of these four AQCRs have a small area in the 62-mile region. The PNPP 62-mile region intersects with a portion of the Steubenville-Weirton-Wheeling Interstate AQCR in the far northern half a mile of Columbiana County, Ohio. The PNPP 62-mile region intersects with a portion of the Mansfield-Marion Intrastate AQCR in the far northwestern 700 feet of Wayne County, Ohio.

The Greater Metropolitan Cleveland Intrastate AQCR is comprised of eight counties in Ohio. These include Lorain, Cuyahoga, Lake, Geauga, Portage, Summit, Medina, and Stark Counties. The Northwest Pennsylvania-Youngstown Interstate AQCR is comprised of three counties in Ohio and 14 counties in Pennsylvania. The Ohio counties include Ashtabula, Mahoning, and Trumbull Counties. The Pennsylvania counties include Cameron, Clarion, Clearfield, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Potter, Venango, and Warren Counties.

As shown in Figure 3.3-6, seven counties in the 62-mile region are not in attainment for 8-hour Ozone (2015). These counties include Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties, Ohio. Eight counties are maintenance areas for 8-hour Ozone (2008). These counties include Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties, Ohio.

As shown in Figure 3.3-7, Cuyahoga and Lorain Counties, Ohio, are maintenance areas for PM-2.5 (2012). Seven counties, Cuyahoga, Lake, Lorain, Medina, Portage, Stark, and Summit Counties, Ohio, are maintenance areas for PM-2.5 (2006). PM-2.5 (1997) was revoked for areas in attainment or maintenance (81 FR 58009); however, Ashtabula, Cuyahoga, Lake, Lorain, Medina, Portage, Stark, and Summit Counties, Ohio, were not in attainment at the time and are now considered to be a maintenance area for the criteria. Cuyahoga County is a maintenance area for PM-10 (1987) and areas within Lawrence County Pennsylvania are maintenance areas for PM-2.5 (2006) and PM-2.5 (1997); however, these areas fall outside of the 62-mile region (see Figure 3.3-7). (EPA 2022b)

As shown in Figure 3.3-8, one county, Lake County, Ohio, is a maintenance area for SO_2 (2010). For SO_2 (1971), Cuyahoga, Lake, and Lorain Counties, Ohio are maintenance areas. As shown in Figure 3.3-9, Cuyahoga County is a maintenance area for CO (1971) and Pb (2008).

3.3.3.2 Air Emissions

The Ohio Environmental Protection Agency (OEPA), Division of Air Pollution Control issues a permit to install and operate (PTIO) emission units pursuant to Chapter 3745-31 of the Ohio Administrative Code. PNPP holds a conditional operating permit to operate two auxiliary boilers in accordance with the provisions of PTIO P0111998. The permitted emission sources at PNPP are regulated by the applicable regulations cited in the permit. (OEPA 2022a) Permitted air emission sources are presented in Table 3.3-9.

The emissions reports submitted to the OEPA each year contain summary information related to the summed emissions from each permitted emissions unit and the emissions from other PNPP emission sources. Emissions from nuclear facilities are produced by using backup diesel generators, boilers, fire pump engines, and cooling towers (NRC 2013a). The permit requires the reporting of Particulate Emissions (PE), SO_2, NO_x, CO, and Volatile Organic Compounds (VOCs). A summary of reported air emissions for the years 2017 to 2021 are presented in Table 3.3-10. Annual emissions for the five years (2017-2021) are listed in Table 3.3-11. Variance in Tables 3.3-10 and 3.3-11 is due to the auxiliary boilers supporting refueling outages on uneven years.

PNPP operational cooling modes of condenser cooling is a closed cycle system. Section 2.2.3.1 details the circulating water system. The magnitude of drift related particulate emissions from cooling towers is discussed in Section 3.3.2 of the GEIS. The factors that limit particulate emissions at PNPP discussed in the GEIS include freshwater use, mechanical design, and annual hours of operation (NRC 2013a). The GEIS further states that air quality impacts due to cooling tower operations would be considered small even in the worst-case situation (no limiting factors). A permit to install cooling towers on the site was in place during construction and currently, emissions from the cooling towers are being evaluated by the OEPA. The OEPA will evaluate the need to include the Unit 1 cooling tower in a future permit. As presented in Chapter 9, there have been no notices of violation (NOVs) or non-compliances associated with PNPP air emissions from 2017-2021. For additional details see Section 9.5.2.1.

As presented in Section 2.3, no license renewal-related refurbishment or other license renewal-related construction activities have been identified. In addition, Energy Harbor's review did not identify any future upgrade or replacement activities necessary for plant operations (e.g., diesel generators, diesel pumps) that would affect PNPP's current air emissions program. Therefore, no increase or decrease in air emissions is expected over the proposed LR operating term.

Studies have shown that the amount of ozone generated by even the largest industry transmission lines in operation (765-kV) would be insignificant (NRC 2013a). As presented in Section 2.2.5, the in-scope transmission lines at PNPP are 22-kV and 345-kV. Therefore, the amount of ozone generated from in-scope transmission lines is anticipated to be minimal.

3.3.4 Greenhouse Gas Emissions

No PNPP data exists for mobile emission sources such as visitors and delivery vehicles. Therefore, Energy Harbor calculated greenhouse gas (GHG) emissions on those direct (stationary and portable combustion sources in Table 3.3-10 reported in PNPP's annual updates and air emissions statements) and indirect (workforce commuting) plant activities where information was readily available. GHG emissions generated at PNPP are presented in Table 3.3-11. As presented in Section 9.5.2.3, PNPP maintains a program to manage stationary refrigeration appliances at the plant to recycle, recapture, and reduce emissions of ozone-depleting substances, including perfluorocarbons and is in compliance with Section 608 of the CAA. Therefore, Energy Harbor did not include potential emissions as the result of leakage, servicing, repair, and disposal of refrigerant equipment in Table 3.3-10.

Table 3.3-1 Regional Wind Conditions, Cleveland (KCLE) Ohio and Erie (KERI) Pennsylvania

Cleveland, Ohio (KCLE)														
	Period of Record (years)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**
Mean Speed (mph)	37	11.3	10.7	10.7	10.3	9.1	8.4	7.8	7.5	8.1	9.3	10.6	10.8	9.6
Prevailing Direction (degrees from)	53	240	240	20	20	210	210	230	230	210	210	200	240	240
Max 3-Second Speed (mph)	25	66	67	62	61	55	62	68	54	54	68	72	67	72
Max Speed Year of Occurrence		2008	2019	2002	2011	2004	2009	1999	2011	2016	2012	2020	2019	Nov 2020
Erie, Pennsylvania (KERI)														
	Period of Record (years)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**
Mean Speed (mph)	37	12	10.9	10.7	10.2	9.2	8.6	8	8	8.9	10.7	11.6	11.8	10.0
Prevailing Direction (degrees from)	46	210	260	260	50	190	190	190	190	190	190	190	210	190
Max 3-Second Speed (mph)	25	68	61	66	63	55	59	61	51	58	54	63	62	68
Max Speed Year of Occurrence		2017	2009	2006	2002	2010	2014	1999	2009	2005	2015	2003	2009	Jan 2017

(NCDC 2022a)

Table 3.3-2 PNPP Wind Conditions (1992-2021)

	Period of Record (years)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Mean Speed (mph)	30	8.7	8.1	7.9	7.5	6.4	5.6	5.3	5.1	5.7	6.9	8.2	8.3	7.0
Prevailing Direction (degrees from)	30	250	250	250	260	260	260	260	210	200	210	210	210	250

Table 3.3-3 Regional Temperatures, Cleveland (KCLE) Ohio and Erie (KERI) Pennsylvania

Cleveland, Ohio (KCLE)														
	Period of Record (years)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**
Mean Daily Maximum (°F)	124	34.4	34.3	45.3	56.3	68.2	76.3	81.3	79.8	72.8	62.4	48.8	38	58.2
Highest Daily Maximum (°F)	79	73	77	83	88	93	104	103	102	101	93	82	77	104
Year of Occurrence		1950	2017	2012	1986	2018	1988	1941	1948	1953	2019	1950	1982	June 1988
Mean Daily Minimum (°F)	124	20.5	20.1	29	38.3	49.5	58.1	63.8	62.4	55.2	45.4	34.9	25.5	41.9
Lowest Daily Minimum (°F)	79	-20	-17	-5	10	25	31	41	38	32	19	3	-15	-20
Year of Occurrence		1994	2015	1984	1964	1966	1972	1968	1982	1942	1988	1976	1989	Jan. 1994
Erie, Pennsylvania (KERI)														
	Period of Record (years)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**
Mean Daily Maximum (°F)	95	33.5	33.6	42.7	54.2	66.1	74.6	79.8	78.4	71.6	61.1	48.5	38	56.8
Highest Daily Maximum (°F)	67	71	77	82	89	90	100	99	94	94	89	80	75	100
Year of Occurrence		2020	2017	1998	1990	2020	1988	1990	2012	1959	2019	1961	1982	June 1988
Mean Daily Minimum (°F)	95	20.7	19.7	27.4	37	48	57.4	63.2	62.1	55.3	45.6	35.8	26.5	41.6
Lowest Daily Minimum (°F)	67	-18	-18	-9	12	26	32	44	37	33	24	7	-6	-18
Year of Occurrence		1994	2015	1980	1982	1970	1972	1963	1982	1974	1975	1976	1983	Feb. 2015

(NCDC 2022a)

Table 3.3-4 PNPP Site Temperatures 1992–2021

	Period of Record (years)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Monthly Average (°F)	30	28.3	29.1	36.4	47.1	58.0	67.4	71.6	70.4	64.4	54.2	43.7	34.1	50.5
Highest Daily Maximum (°F)	30	70.7	75	80.8	86.1	90.8	91.9	95.9	92.3	91.8	86	78.8	73.5	95.9
Year of Occurrence	30	2020	2000/2017	1998	2009	1996	2008	1999	2006	2013	2019	2020	2001	1999
Lowest Daily Minimum (°F)	30	-17.9	-17.5	-4.4	17.7	30.4	39.0	47.6	46.7	37.3	29.3	17.2	-1.6	-17.9
Year of Occurrence	30	1994	2015	2014	2016	2002	1992	2013	1992	1995	2020	2005	1993	1994

a. Calculated average of all temperature measurements for each month and of all measurements for the period January 1992-December 2021

Table 3.3-5 Regional Precipitation, Cleveland (KCLE) Ohio and Erie (KERI) Pennsylvania (Sheet 1 of 2)

Cleveland, Ohio (KCLE)														
	Period of Record (years)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**
Normal Monthly Precip. (inches)	30	2.72	2.34	2.93	3.49	3.66	3.43	3.46	3.51	3.81	3.07	3.62	3.1	39.14
Maximum Monthly Precip. (inches)	79	7.01	5.54	6.07	6.89	9.14	9.06	9.12	9.03	11.05	10.4	8.8	8.59	11.05
Year Occurred		1950	2008	1954	2011	1989	1972	1992	2007	1996	2012	1985	1990	Sep. 1996
Maximum 24 Hr. (inches)	79	2.53	2.53	2.76	2.24	3.73	4.05	3.65	3.85	5.24	3.44	7.73	2.81	5.24
Year Occurred		1995	2008	1948	1961	1955	2014	2011	2011	1996	1954	1985	1992	Sep. 1996
Minimum Monthly Precip. (inches)	79	0.36	0.48	0.78	1.18	0.66	0.65	0.68	0.53	0.74	0.61	0.76	0.71	0.36
Year Occurred		1961	1978	1958	1946	2007	1988	2001	1969	1964	1952	2012	1958	Jan. 1961

Table 3.3-5 Regional Precipitation, Cleveland (KCLE) Ohio and Erie (KERI) Pennsylvania (Sheet 2 of 2)

Erie, Pennsylvania (KERI)														
	Period of Record (years)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**
Normal Monthly Precip. (inches)	30	2.95	2.39	2.95	3.33	3.44	3.76	3.54	3.47	4.61	4.05	3.93	3.74	42.16
Maximum Monthly Precip. (inches)	67	6.23	5.73	6.79	7.11	8.54	8.46	7.7	11.06	10.65	9.87	10.4	7.55	11.06
Year Occurred		2007	1990	1976	1961	2011	2017	1970	1977	1977	1954	1985	2017	Aug. 1977
Maximum 24 Hr. (inches)	67	1.63	2.16	2.38	2.53	2.34	4.66	3.22	4.07	6.11	4.35	3.67	2.39	6.11
Year Occurred		1998	1961	1987	1977	2013	1996	1970	2016	1979	1954	1985	1979	Sep. 1979
Minimum Monthly Precip. (inches)	67	0.87	0.57	0.63	1.63	1	0.75	0.52	0.5	1.33	1.13	1.35	1.38	0.5
Year Occurred		1981	1978	1960	1975	1991	1991	2001	2002	1995	1963	2009	1960	Aug. 2002

(NCDC 2022a)

Table 3.3-6 PNPP Precipitation Records (1992–2021)

	Period of Record (years)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Average Monthly Precip. (inches)	30	2.6	1.8	2.7	3	3.2	3.3	3.9	3.7	4	4.1	3.6	2.9	38.8
Maximum Monthly Precip. (inches)	30	5.9	5.1	7.4	5.6	6.9	6.9	12.9	6.2	8.7	9.3	6.3	4.8	53.8
Year Occurred	30	2017	2008	2002	2000	2017	2015	2006	2021	2003	2012	2017	2007	2006
Minimum Monthly Precip. (inches)	30	0.82	0.59	0.60	1.06	1.11	1.07	1.14	1.23	1.17	1.76	1.17	0.99	25.2
Year Occurred	30	2016	1999	1996	2012	1993	2002	2002	2003	1995	2015	2009	1995	1999

Table 3.3-7 Regional Thunderstorms, Cleveland (KCLE) Ohio and Erie (KERI) Pennsylvania

Cleveland, Ohio (KCLE)													
Period of Record (years)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**
73	0.2	0.5	1.6	3.2	5	6.4	6.5	5.3	3.4	1.5	0.9	0.3	34.8
Erie, Pennsylvania (KERI)													
Period of Record (years)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**
66	0.2	0.3	1.1	2.4	3.7	5.5	5.8	5.4	3.7	1.8	1.1	0.3	31.3

(NCDC 2022a)

Table 3.3-8 PNPP Stability Class Distributions

Percent Frequency of Occurrence by Pasquill Stability Class							
YEAR	**A**	**B**	**C**	**D**	**E**	**F**	**G**
2017	1.8	3.6	5	30.9	39.6	8.2	10.8
2018	12.8	4.9	6.6	34.1	27.3	6.6	7.7
2019	18.8	6.5	9.9	35	15.4	6.1	8.3
2020	22.7	6.1	8.7	35.5	13.8	4.9	8.4
2021	22.8	5.7	7	36.3	13.8	6	8.4
2017-2021	19.2	5.8	8.1	35.2	17.6	5.9	8.2

a. Classes are as follows (NRC 2007, Regulatory Guide 1.23, Table 1):
Class A: Extremely unstable
Class B: Moderately unstable
Class C: Slightly unstable
Class D: Neutral
Class E: Slightly stable
Class F: Moderately stable
Class G: Extremely stable

Table 3.3-9 PNPP Permitted Air Emission Sources

Emission Source [a,b]	Description	Capacity Rating	Permit Conditions [c]
B001[b]	Auxiliary Boiler A	124.5 MMBtu/hr	Opacity shall not exceed 20 percent as a 6-minute average. Total PE limited to 0.020 lb/MMBtu. SO_2 emissions shall not exceed 1.6 lb/MMBtu.
B002[b]	Auxiliary Boiler B	124.5 MMBtu/hr	Opacity shall not exceed 20 percent as a 6-minute average. Total PE limited to 0.020 lb/MMBtu. SO_2 emissions shall not exceed 1.6 lb/MMBtu.

(OEPA 2022a)

[a] Emission Source unit reference is from OEPA 2022a.

[b] Also subject to 40 CFR Part 63, Subpart JJJJJ - National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources.

[c] For a full discussion of Air Permit Conditions see OEPA 2022a, Permit No. P0111998.

Table 3.3-10 PNPP Reported Annual Air Emissions Summary, 2017–2021

Annual Emissions (tons/year)						
Year	**PM**	**SO_2**	**NO_X**	**CO**	**VOC**	**CO_2e**
2021	0.39	0.189	10.616	2.76	0.28	1504.42
2020	0.22	0.063	6.901	1.82	0.19	502.57
2019	0.44	0.267	11.158	2.86	0.28	2125.07
2018	0.23	0.052	7.188	1.91	0.20	420.96
2017	0.40	0.252	9.791	2.50	0.25	2002.97

Table 3.3-11 PNPP Annual Greenhouse Gas Emissions Inventory Summary, 2017–2021

Carbon Dioxide Equivalent (CO_2e) Emissions, Metric Tons					
Emission Source	**2017**	**2018**	**2019**	**2020**	**2021**
Combustion Sources [(a)]	1,817	382	1,928	456	1,365
Workforce Commuting [(b)]	2,828	2,828	2,828	2,828	2,828
TOTAL	4,645	3,210	4,756	3,284	4,193

(a) Fuel usage for combustion sources shown Table 3.3-10; 40 CFR Table A-1 to Subpart A of Part 98 - Global Warming Potentials.

(b) Workforce commuting calculations are based on:

1. Statistical information from U.S. Census Bureau indicates that 4.6 percent of Ohio workers in the Transportation and Warehouse and Utilities Industry carpool to work (USCB 2022f). Number of PNPP employees as of December 2020 was 645. Utilizing the 4.6 percent USCB carpool statistic, a value of "615" passenger vehicles per day was utilized.
2. The EPA's Greenhouse Gas Equivalencies Calculator the CO2e/year to be 2,947 metric tons for 641 vehicles (EPA 2022a).
3. Carbon dioxide equivalent (CO2e) means the number of units of another greenhouse gas that has the same global warming effect as a single unit of carbon dioxide (CO2).
4. As an example, 25 metric tons of CO2 emissions has the equivalent global warming effect as a single metric ton of methane emissions (Based on Table A-1 to Subpart A of 40 CFR Part 98).

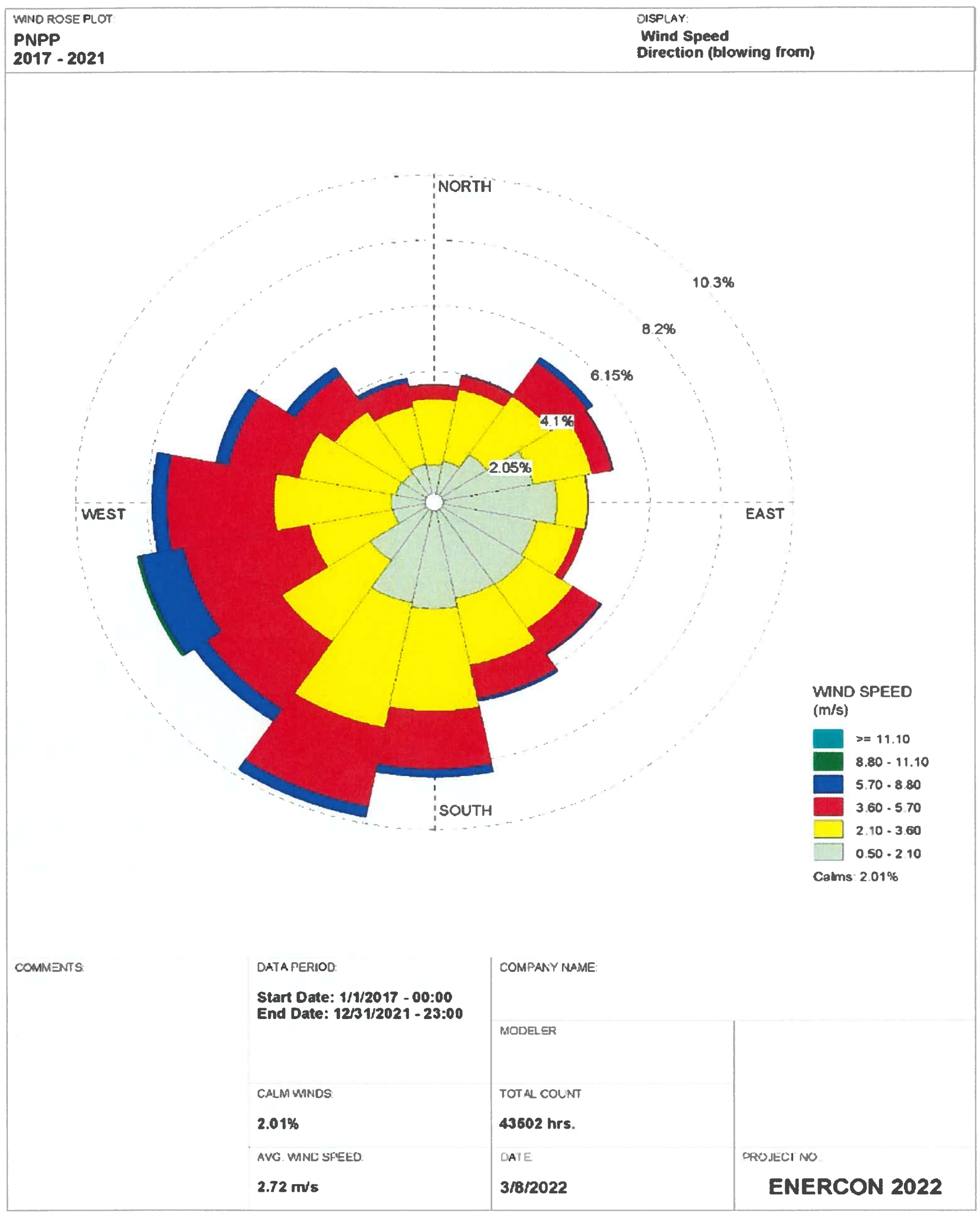


Figure 3.3-1 2017-2021 PNPP Wind Rose

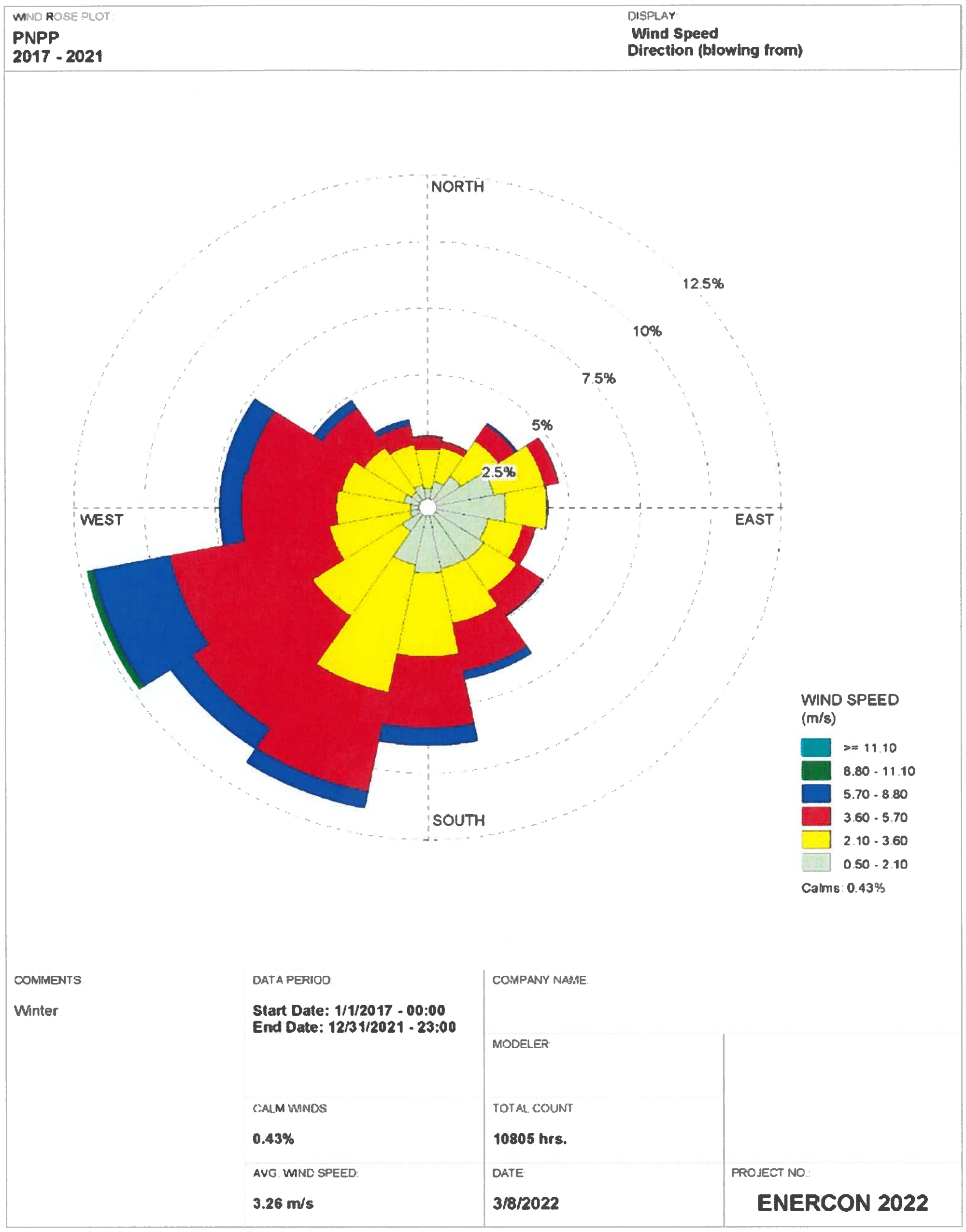


Figure 3.3-2 2017–2021 PNPP Winter Wind Rose

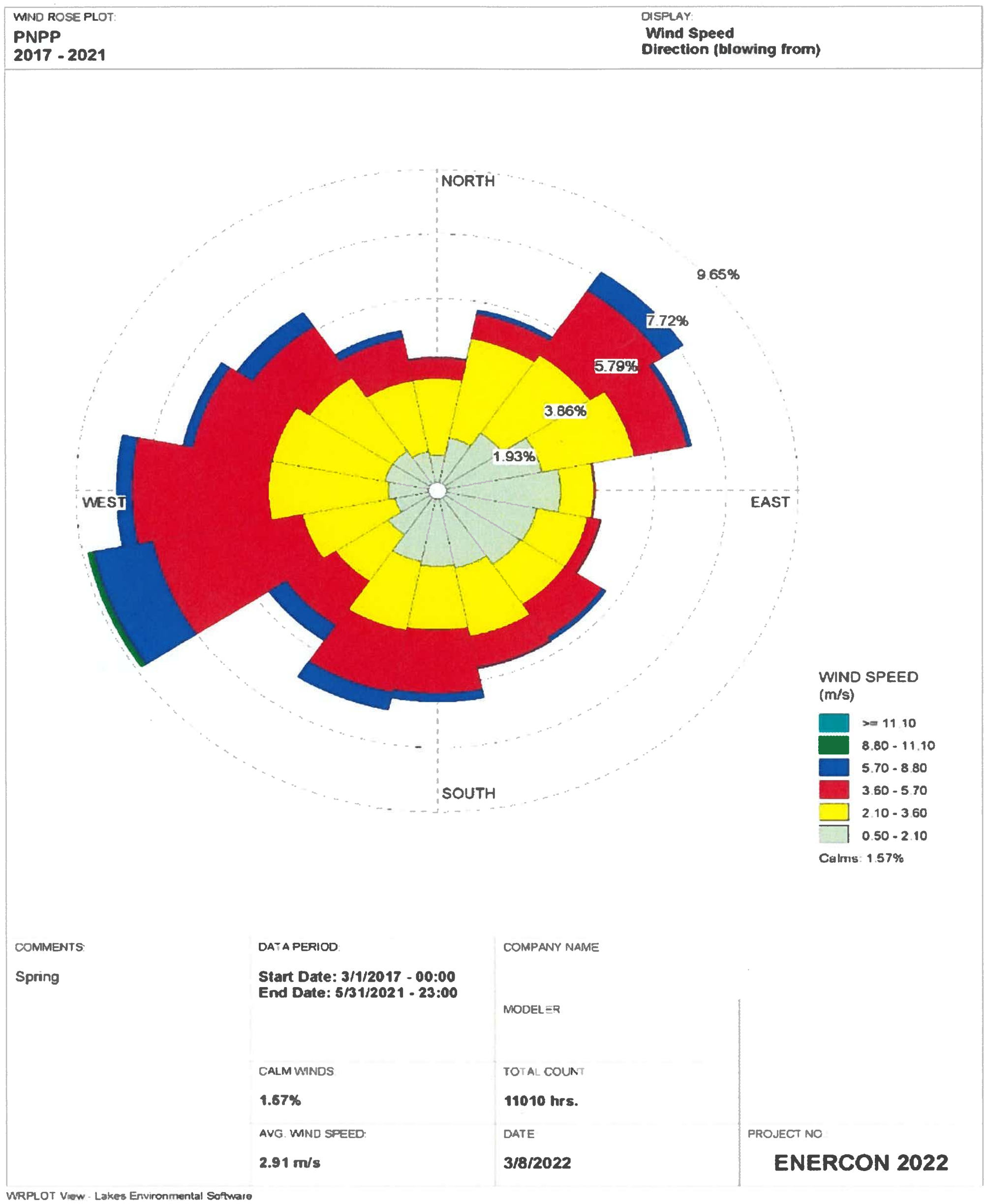


Figure 3.3-3 2017–2021 PNPP Spring Wind Rose

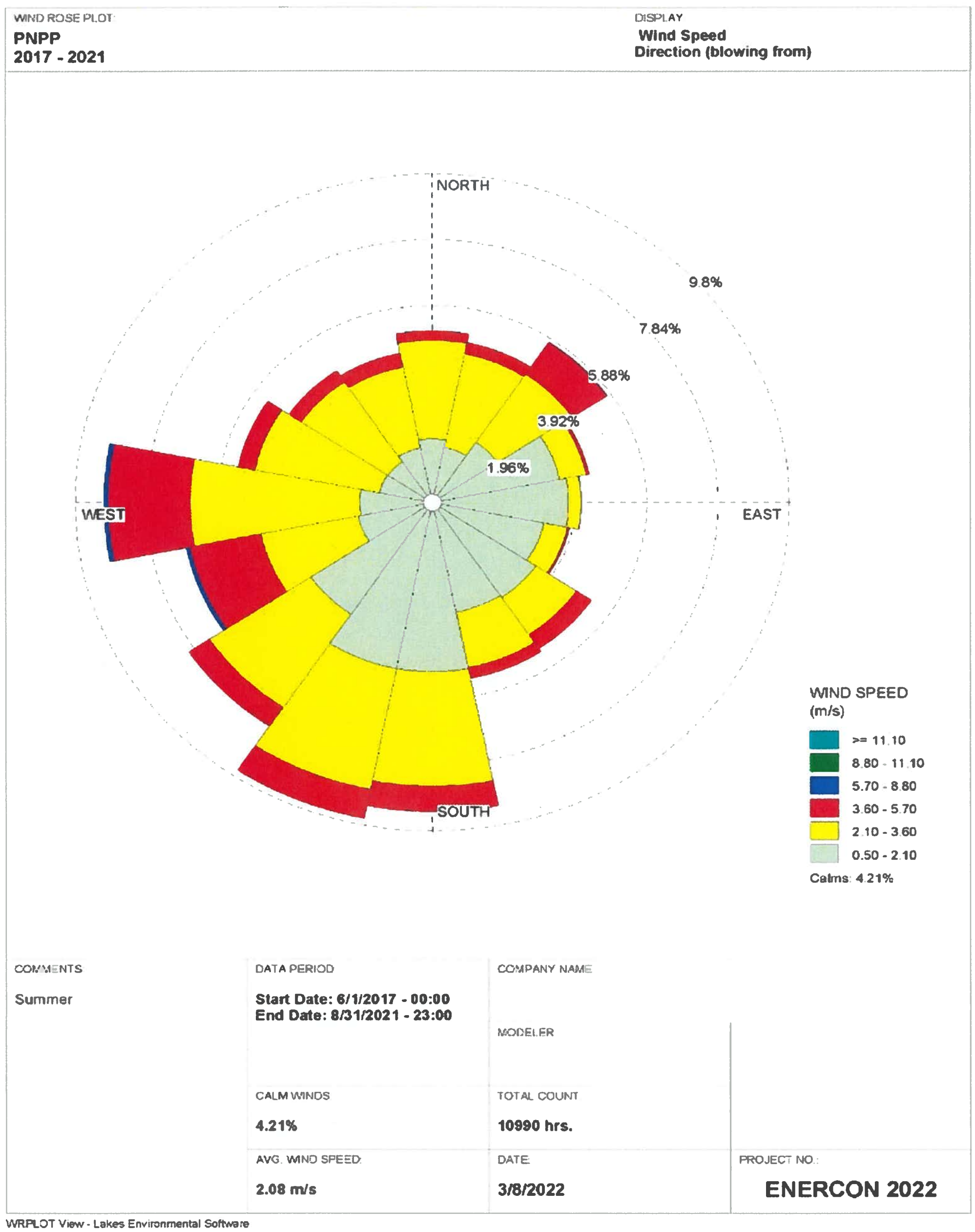


Figure 3.3-4 2017–2021 PNPP Summer Wind Rose

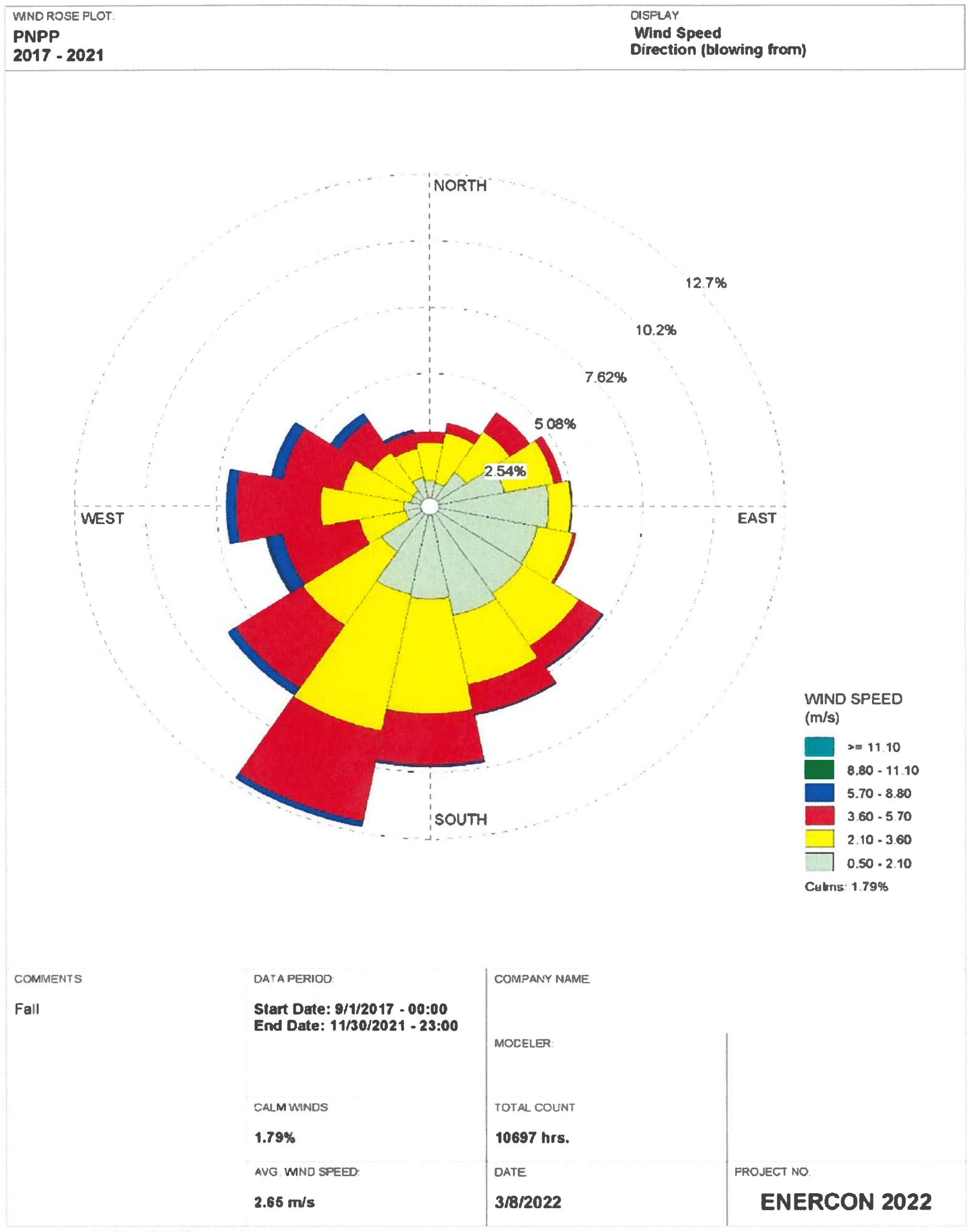


Figure 3.3-5 2017–2021 PNPP Fall Wind Rose

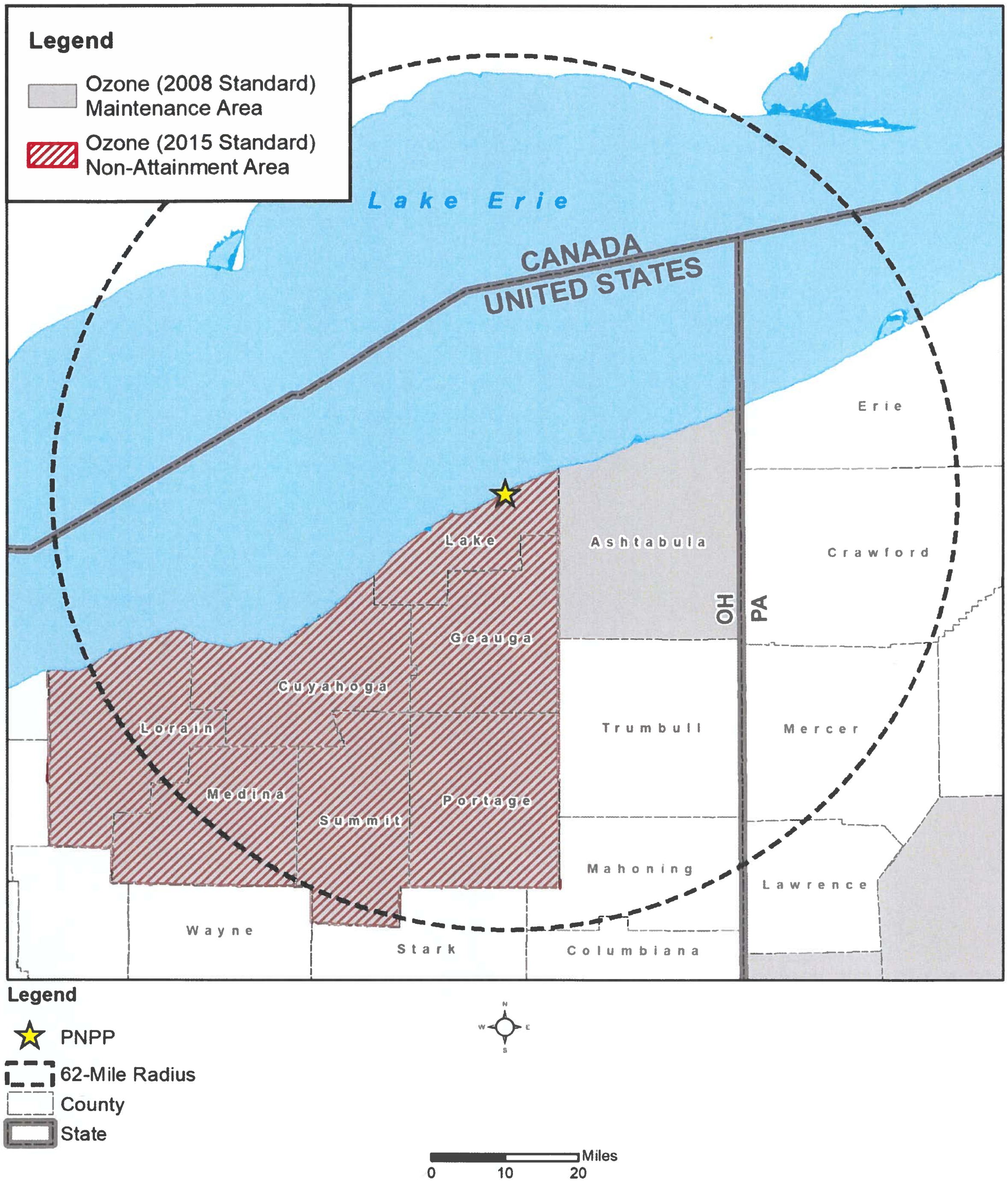


Figure 3.3-6 Nonattainment and Maintenance Areas for Ozone 2008 and 2015

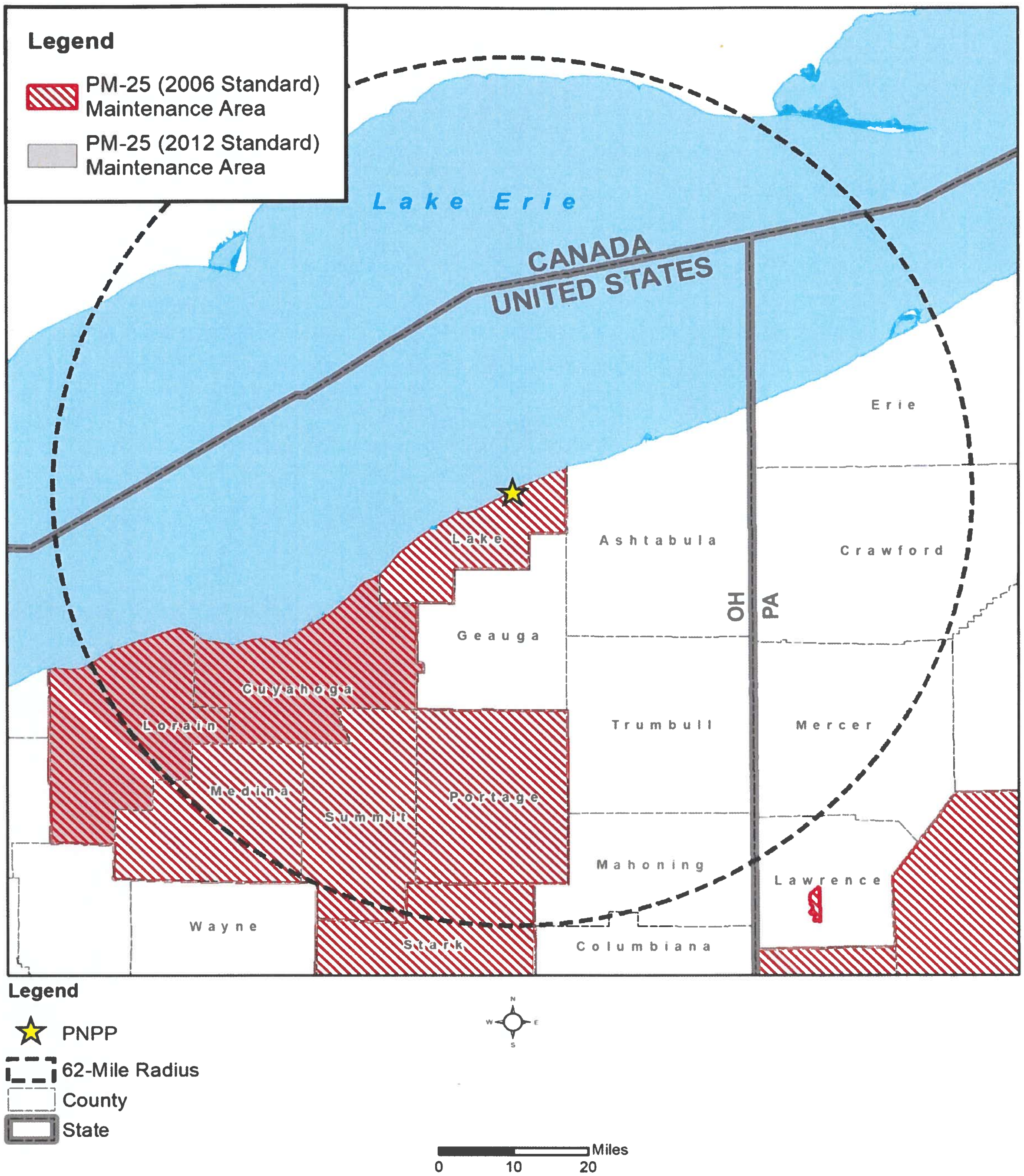


Figure 3.3-7 Nonattainment and Maintenance Areas for Particulate Matter 2006 and 2012

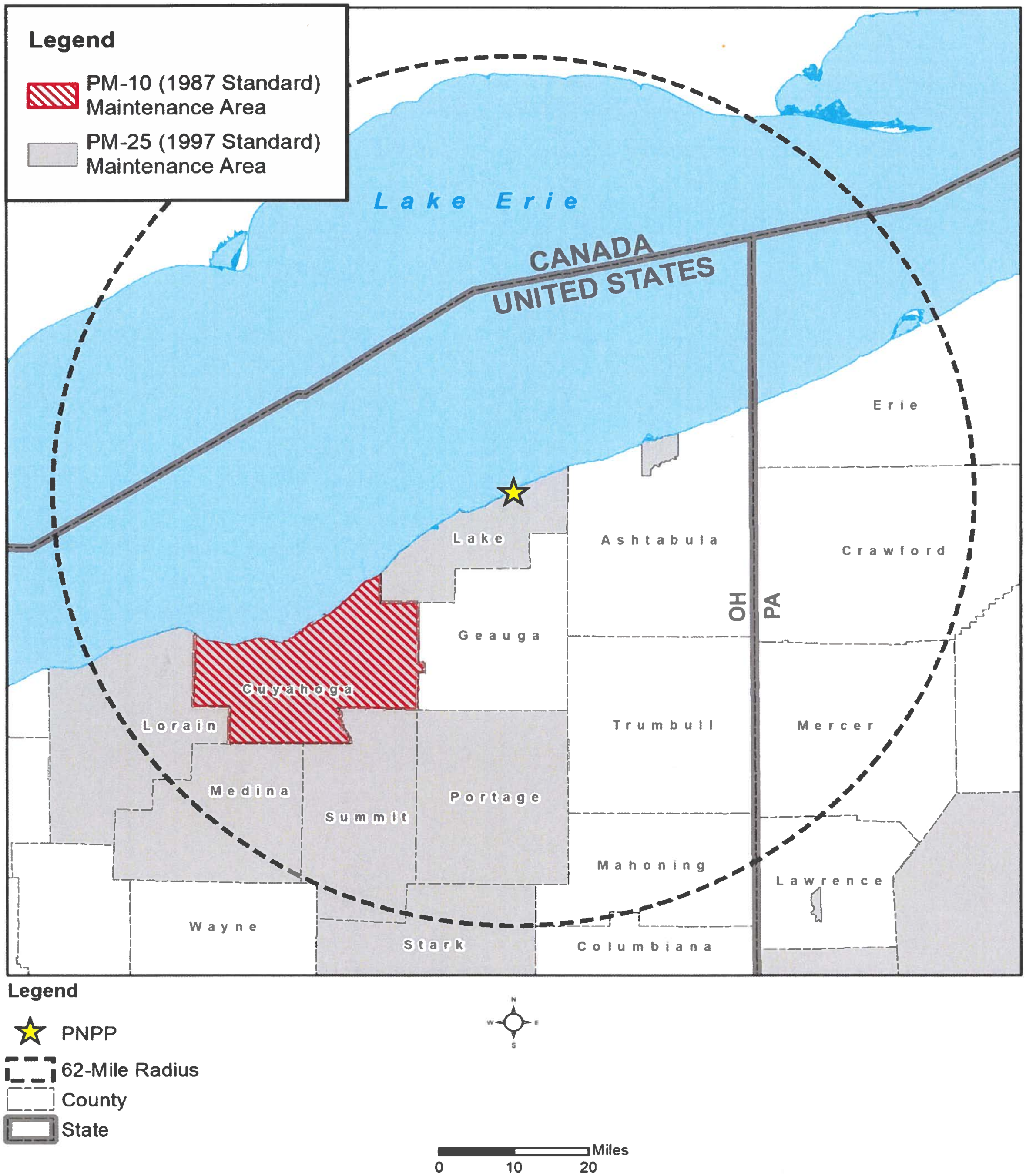


Figure 3.3-8 Nonattainment and Maintenance Areas for Particulate Matter 1987 and 1997

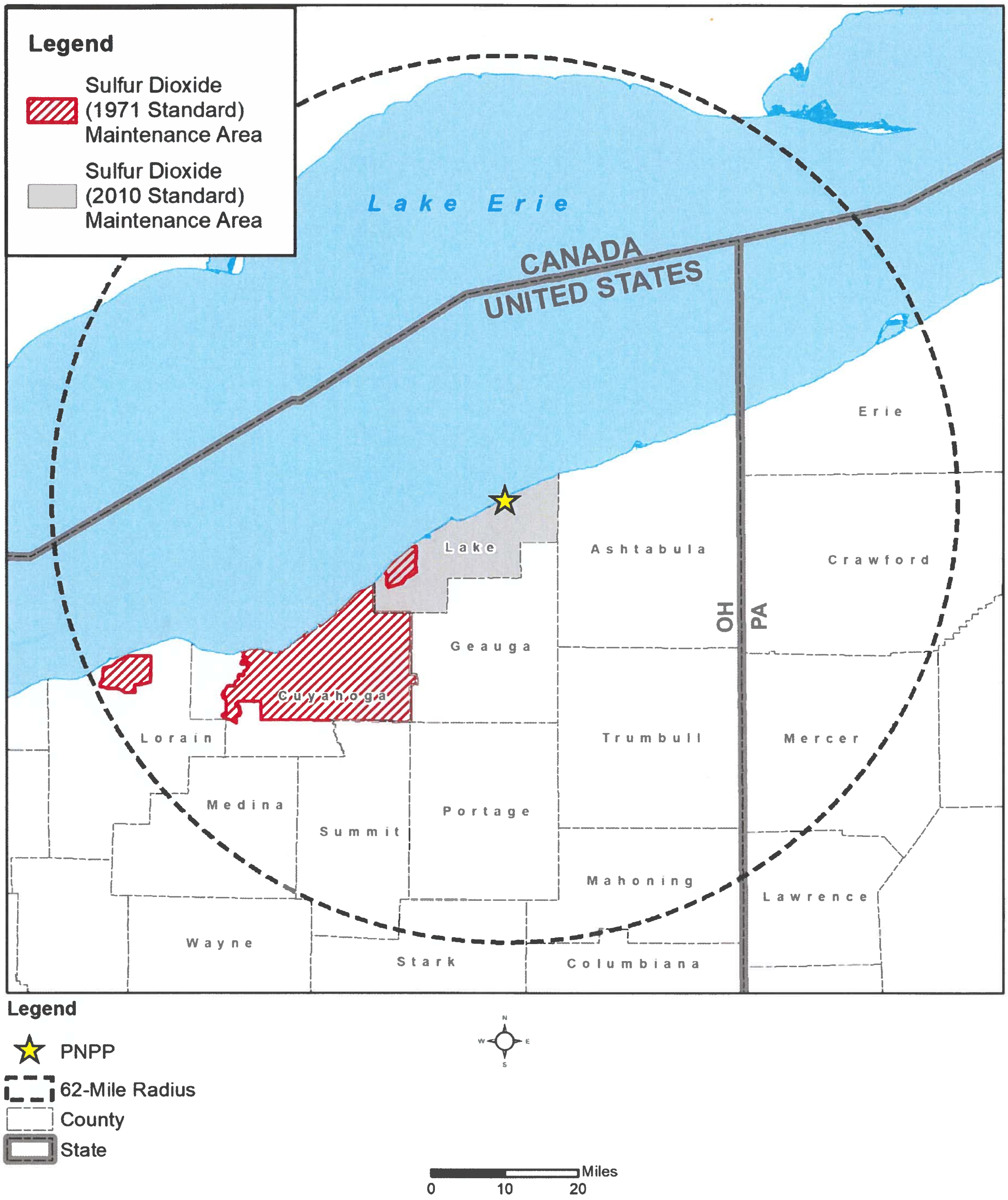


Figure 3.3-9 Nonattainment and Maintenance Areas for Sulfur Dioxide 1971 and 2010

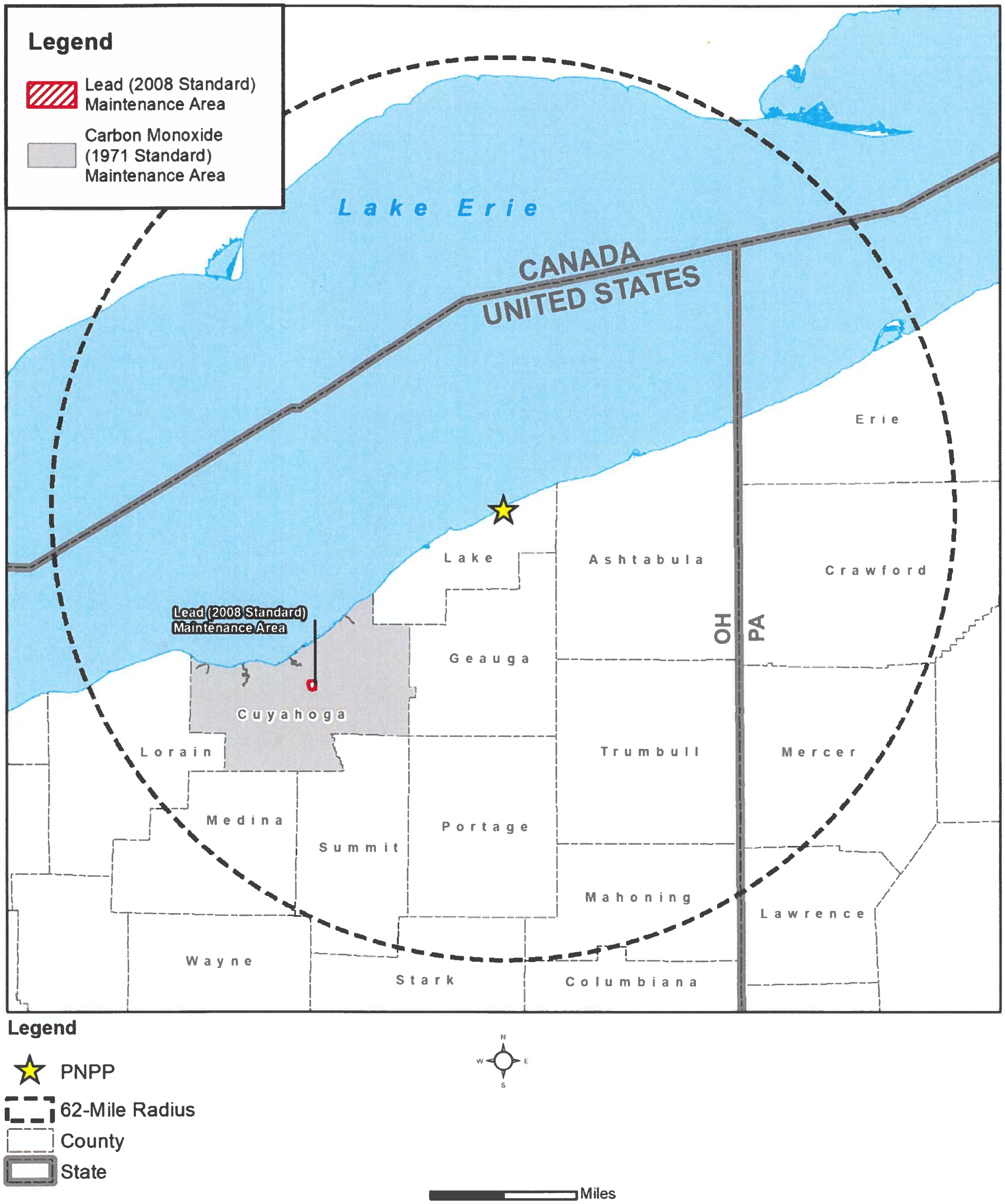


Figure 3.3-10 Nonattainment and Maintenance Areas for Carbon Monoxide and Lead 1971 and 2008

3.4 Noise

Noise is produced at PNPP from industrial plant operations and site activities. Industrial background noise at PNPP is generally from operation of pumps, turbines, generators, switchyard equipment, transformers, cooling tower, and loudspeakers.

Apart from PNPP, North Perry is primarily a residential and agricultural community. Approximately 45 percent of the land is classified under these categories. (NPV 2022b) The PNPP site is designated as general industrial by the North Perry Village Planning and Zoning Code. The planning and zoning code for general industrial is established to accommodate industrial activities in areas for such development that have a generally clean character, and which normally generate only limited outdoor activities that are clean, quiet, and free of hazardous or objectionable elements such as noise, odor, smoke, contaminants, and glare. (NPV 2022a)

Sound levels from normal plant operations at PNPP have not been surveyed, and neither the state of Ohio nor Lake County have regulations in place for environmental noise. North Perry has proactively adopted regulations intended to regulate and buffer fixed point sources of noise-requiring large buffer zones, berms, and/or masonry walls between residential and commercial uses (NPV 2022b). Noise from operations at PNPP is attenuated across the forested land surrounding the site. Beyond the general noise from operations, periodic use of the firing range is another onsite activity that creates occasional noise. The firing range is approximately 2,000 feet from the closest residence to the site in the southwest direction. (EH 2021b)

Because PNPP is located in a generally rural area (away from urban areas), it is unlikely that noise level from PNPP would affect offsite residences. This is further substantiated by the fact that during the most recent five years (2017-2021), no noise complaints have been received by PNPP from offsite residences as it relates to PNPP plant operational and outage activities. Additionally, most noise generating equipment is located inside structures, further reducing the outside noise level from plant operations. Therefore, no noise issues affecting offsite residences are anticipated during the LR operating term as noise levels at PNPP are expected to remain the same as under current operating conditions.

There have been no internal noise complaints made by PNPP staff in the last five years. No cases of threshold shifts requiring U.S. Occupational Safety and Health Administration (OSHA) reportability have occurred in the past 10 years.

PNPP's Industrial Safety Controls related to hearing protection of plant workers requires hearing protection be worn at all times in areas which are posted "Hearing Protection Required." Plant workers are required to wear plugs and muffs in combination when working in areas where the sound level exceeds 105 A-weighted decibels (dBA).

3.5 Geologic Environment

3.5.1 Regional Geology

The PNPP site is in northern Ohio on the south shore of Lake Erie, which falls within the Central Lowlands physiographic province (Figure 3.5-1). The Central Lowlands province is the largest of the physiographic provinces in the contiguous United States, spanning 585,000 square miles. This largely level region rises less than 1,000 feet above mean sea level (msl) in the east to less than 2,000 feet above msl in the west. The Central Lowlands were subject to repeated Pleistocene glaciations and can be divided into regions based on glacial features, including the Great Lakes, Small Lakes, Driftless Area, Till Plains, Dissected Till Plains, and Osage Plains. Underlying glacial deposits are largely horizontal Paleozoic sandstones, shales, limestones, conglomerates, and coals. (NPS 2021)

The Central Lowland province is characterized by a low-relief surface formed by glacial till, outwash plains, and glacial-lake plains. Long, low, arcuate ridges, which were formed by recessional moraines and generally are concave to the north, are common features on these plains. The glacial deposits that compose the ridges and plains have completely buried the preglacial topographic features of most of the segment. Parts of the buried bedrock valleys contain unconsolidated deposits of sand and gravel that constitute productive aquifers. (Lloyd and Lyke 1995)

PNPP lies within the Lake Plains section of the Central Lowland province. The Lake Plains section is characterized by a narrow band of low relief terrain, 5-10-miles wide, along the southeast shore of Lake Erie. South of PNPP, the narrow Lake Plains section is adjoined by the Glaciated Plateau section of the Appalachian Plateau physiographic province. This boundary, commonly referred to as the Allegheny Escarpment, trends in a general northeast-southwest direction from the Pennsylvania border to north-central Ohio, where its bearing changes to a more southerly direction. The Allegheny Escarpment is recognized as an abrupt change in relief, approximately 100 feet, in northeastern Ohio. In south-central Ohio, the Glaciated Plateau section has a common boundary with the Till Plains section of the Central Lowland province. PNPP is on a portion of the Lake Plain that was submerged in the geologic past when the level of Lake Erie was considerably higher than the present level. Approaching the present shoreline of Lake Erie, the flat terrain gives way to a steep bluff that forms most of the shoreline in northeastern Ohio. The average height of the bluff is approximately 45 feet. (EH 2021a)

PNPP is situated within the eastern portion of the Central Lowland physiographic province. This province is founded on a buried supracrustal platform or craton composed of Precambrian crystalline basement rock overlain by variable thicknesses of Paleozoic sediments, generally on the order of several thousand feet. A surficial veneer of Pleistocene glacial and lacustrine deposits is present throughout much of the province, including the site. The Precambrian crystalline basement is not exposed anywhere in Ohio, but it underlies the site vicinity approximately 5,000 feet below surface. Basement structures are inferred based on direct and indirect data, which include both local trends and regional features consisting of the Lake

Superior syncline in Wisconsin, Minnesota, and Iowa, and the Grenville metamorphic or orogenic front presumably traced from eastern Canada southward into Michigan and Ohio, and the Akron Magnetic Boundary representative of regional scale lithologic differences in the crystalline basement. (EH 2021a)

PNPP is on the northwestern flank of the Appalachian geosyncline. Bedrock directly beneath the site belongs to the Ohio Shale formation (Upper Devonian) (Figure 3.5-2). To the south, these Devonian strata are overlain by successively younger Paleozoic sediments and Pleistocene glacial deposits, respectively. These rocks dip gently to the south at a gradient of approximately 20 to 40 feet per mile. This paleo topographic surface was eroded because of continental glaciation forming Lake Erie along with the Great Lakes during the Pleistocene Epoch. Lake Erie is the shallowest of the Great Lakes, with a maximum depth of 210 feet and an average depth of 58 feet. The western end of the lake is extremely shallow, as much of the lake bottom is immediately underlain by resistant carbonate bedrock. From the general vicinity of Sandusky, Ohio, to the east beyond the Pennsylvania boundary, Lake Erie has been eroded into Upper Devonian shales, which overlie the more resistant rocks comprising lake bottom strata of the western portion. All but southeastern Ohio has been extensively mantled by Pleistocene glacial deposits. Consequently, bedrock exposures are sparse particularly in proximity to the local area of PNPP. (EH 2021a)

3.5.2 Site Geology

Glacial materials cover more than two-thirds of Ohio. In northeastern Ohio, glacial drift and glaciolacustrine sediments overlying bedrock reach a maximum thickness of approximately 250 feet. The glacial deposits are dominantly till composed of native material with some ice-transported granitic erratics derived from Canada. Composition of the till varies from place to place but in general is a heterogeneous, dense, boulder clay with interspersed rock fragments ranging from large boulders, cobbles, and pebbles down to sand size. Along the lake front, a layer of glaciolacustrine deposits composed of clay, silt, and fine sand mantle dense tills. Sandy beach ridges located 1.5-10 miles inland from the present shore delineate former lake margins. (EH 2021a) As described in Section 3.1.2, Energy Harbor has a lease agreement with the State of Ohio to prevent halite mining within approximately 410 acres of submerged land extending from the shore of Lake Erie.

The shoreline of Lake Erie in Lake County is formed by eroding steep bluffs and discontinuous narrow beaches. No bedrock is exposed in the bluff or along the shore. Bluff materials overlying shale bedrock comprise glacial till covered by lacustrine deposits. The geologic characteristics of the surface materials are the result of glacial action during the Pleistocene age. For the 6,000 feet of shoreline along the northern boundary of PNPP, the bluffs are approximately 45 feet high (EH 2021a). The plant site is on nearly level terrain with the main plant being about 800 feet from the toe of the bluff (EH2021a). The bluff consists of five to 15 feet of dense, glacial till at its base overlain by lacustrine silt and clay deposits. The till is approximately 75 percent silt and clay, 15 to 20 percent sand, and the remainder is rock fragments. On the top of the bluff is a stratum of silty fine sand from about four to seven feet thick. Materials exposed in the bluff are of similar geologic cross section as those encountered at the plant site proper. One beach exists northwest of PNPP approximately 900 feet long and 50 to 75 feet wide with beach sands of about five feet in thickness overlying till. (EH 2021a)

PNPP site geology encountered during plant construction includes four units: Glacial Lacustrine deposits, Upper Till, Lower Till, and Chagrin Shale (bedrock). Monitoring wells, test borings, and piezometers installed during PNPP construction indicate the relative thickness and elevation intervals for each of these units as follows:

- Glacial Lacustrine, 0-20 feet below ground surface, 620-600 feet msl
- Upper Till, 20-30 feet below ground surface, 600-590 feet msl
- Lower Till, 30-60 feet below ground surface, 590-560 feet msl
- Chagrin Shale, 50+ feet below ground surface, 570 feet msl and below

The surfaces of all four of these units generally slope toward Lake Erie. The Glacial Lacustrine sediments and upper Chagrin Shale were excavated during construction to approximately 560 feet. A columnar geologic cross section is shown in Figure 3.5-3.

The bedrock stratigraphy of Ohio includes a basal Precambrian crystalline basement overlain by a sequence of Paleozoic sedimentary rock. Precambrian rocks are not exposed in Ohio. (EH 2021a) The Precambrian surface in the region is about 5,300 feet below sea level (EH 2021a)

A Devonian-Mississippian stratigraphic interval dominated by shale forms the bedrock surface of an eight to 20-mile-wide belt contiguous to Lake Erie from the Pennsylvania border to the vicinity of Sandusky, and from there, southward through central Ohio to the Ohio River. (EH 2021a) Mineral resources in the northeastern Ohio portion of the Central Lowlands province are restricted to nonmetallic occurrences with a considerable quantity of sand and gravel (EH 2021a).

In the northeastern region of Ohio, a complete columnar section through the shale sequence, youngest to oldest, is the Bedford, Cleveland, Chagrin, Huron, and Plum Brook shale members. Collectively, these members comprise approximately 1,500 feet of stratigraphic section of the site locale. (EH 2021a) The Cleveland, Chagrin, and Huron shales together are also known as the Ohio Shale, representing most of the Devonian-Mississippian shale sequence in northeastern Ohio. The composite interval is overlain by the Berea Sandstone and underlain by Middle Devonian carbonate rocks. (EH 2021a)

The Huron Shale, stratigraphically averaging 410 feet throughout Ohio, is a black fissile shale containing conspicuous carbonate concretions. Its base is placed at the top of the highest gray shale (or limestone) bed of the underlying Plum Brook Shale. The top of the Huron is placed at the highest black shale where the gray, slightly arenaceous Chagrin Shale begins. In some locales, the base of the Chagrin is conspicuous, beginning at the top of the uppermost layer of carbonate concretions (generally from one to six feet in diameter, but as large as 15 feet) or at the base of the lowermost Ohio Shale cone-in-cone structure. The Chagrin Shale is essentially a non-carbonaceous, medium-gray, fissile, clay shale occupying an intermediary position between two highly carbonaceous fissile blue-black shales. The Cleveland Shale is readily distinguished from the Chagrin by a darker color and from the Huron by the absence of large calcareous concretions. Primary and secondary deposits of pyrite, occurring along thin bedding laminae as concretionary masses and/or as finely disseminated pyrite, are best developed in the Cleveland Shale. Regionally, the irregular distribution, variable thickness, the horizontal gradation, and vertical transitory nature, characterizing the stratigraphy of the Ohio Shale, can be readily understood in context of the facies concept. (EH 2021a)

Bedrock reaching the surface in Lake County is chiefly shale and lesser amounts of sandstone. Bedrock exposures are sparse, as most of the surface is concealed by glacial deposits. The nearest outcrops to PNPP are approximately 7 miles southwest along the banks of the Grand River. (EH 2021a)

At PNPP, the Upper Devonian Chagrin shale is the highest (youngest) Ohio Shale member (EH 2021a). The Chagrin and Huron shale members of the Ohio Shale are encountered beneath 40 to 50 feet of glacial drift and extends to depths on the order of 1,250 feet below the ground surface. Within the depth of plant area exploration (730 feet), cores of the non-carbonaceous Chagrin shale are usually identified as dark gray to medium-gray silty or clayey shale occasionally containing light gray sandy shale laminae, whereas the Huron shales are black to dark brown with lesser amounts of thinly bedded light gray silty and sandy laminae. (EH 2021a)

Additional underlying Devonian and Silurian rocks underlying the Ohio Shale include the Delaware, Columbus, Oriskany, Helderberg, Bass Islands, Salina, and Lockport. The sequence of carbonate and evaporite rocks (Oriskany, through Lockport) is referred to as the "Big Lime" of Ohio. (EH 2021a)

Devonian rocks associated with the Columbus and Delaware Limestones are usually identified as a hard, dense, cherty limestone, or a dolomitic limestone. The lower Columbus is medium to massively bedded and fine-grained in texture, whereas the Delaware is thin to medium-bedded, fossiliferous, and more frequently jointed. No evidence of solution voids within the formation is known to have been reported. This is consistent with the low porosity and permeability of most of these carbonate rocks. (EH 2021a)

The rocks of the Oriskany are usually identified as a fine-grained sandstone and occasionally as a medium to fine-grained sandstone. Primarily because of the very limited local thickness (eight to 17 feet) within the area of study, the sandstone is important only as a marker bed for stratigraphic correlation. This unit is a source of natural gas near Mentor, Ohio, about 14 miles southwest of the site. (EH 2021a)

Argillaceous, dolomitic limestone and calcareous dolomite belonging to the Bass Islands Dolomite, and possibly overlying Helderberg Limestone, are present within the area of study. These rocks are encountered at depths on the order of 1,600 feet at the base of the overlying Devonian system. Locally, the Bass Islands and Helderberg are estimated to be about 150 feet thick and contain dolomitic shale interbeds in the lower 30 to 40 feet. No solution cavities within these rocks are reported, consistent with low porosity and relative impurity of most of the carbonate rocks. (EH 2021a)

Salt deposits exist regionally and are being exploited within Cuyahoga and Lake Counties, Ohio. Salt beds of the Salina Group underlie all or a part of 23 counties in eastern Ohio. Since 1889, these beds have been commercially developed by both conventional and solution mining. Within the locale of PNPP, solution mining was conducted by the Diamond Shamrock Chemical Company, and room and pillar mining is currently conducted by the Morton Salt Division of Morton Thiokol, Inc. In the period from 1980 to 1989, rock salt production in Cuyahoga and Lake counties has remained relatively stable (3.3 million tons per year) except for 1983 (1.7 million tons). (EH 2021a) The Salina Group is a sequence of interbedded evaporite, and carbonate rocks encountered in the site vicinity at depths on the order of 1,750 feet. (EH 2021a)

Measurable subsidence within the area of study could be realized if within the salt measures cavities of sufficient size closed. Cavities could be produced by conventional deep mining, by solution mining, or by inadvertent solutioning due to the intrusion of aggressive waters through abandoned wells. Natural solution cavities would also be a potential source of surface distortion. (EH 2021a) Should salt mining be initiated within 1,000 feet of the mineral rights boundary, a subsidence monitoring system, independent of the mining operator, will be installed and maintained during the life of the plant. The monitoring system will consist of surface monuments located within the protected area in the immediate proximity of all production wells drilled closer than 1,000 feet to the mineral rights boundary of the plant. Monument location, spacing, and the survey frequency would be designed to enable early detection and detailed documentation of any surface subsidence. Should subsidence within the "protective zone" surrounding the plant area be detected, action will be taken immediately to prevent continued operation of the causative mining. (EH 2021a)

The Lockport Group includes strata of Niagaran age. The uppermost shale strata of the Rochester shale, considered to be the base of the "Big Lime," are encountered within the site environs at an approximate depth of 2,670 feet. Locally, the overlying Lockport Group is composed of about 250 feet of dolomite. The uppermost strata of the Lockport include as much as 40 feet of finely crystalline dolomite. These strata are referred to as the "Newburg Sand," which regionally are a source of natural gas and petroleum. (EH 2021a)

The occurrence of surface subsidence due to extraction of natural gas or fluids is attributed to a reduction of interstitial pore pressures within producing zones. Reduced pressure causes an increase in intergranular stress and subsequent consolidation of the zone of withdrawal. Subsidence due to extraction of natural gas from the Silurian and Devonian rocks underlying northeastern Ohio has not been experienced. These reservoir strata were lithified into a competent rock mass. (EH 2021a)

3.5.3 Soils

3.5.3.1 Onsite Soils and Geology

Soils in the locality of the site are derived predominantly from glaciolacustrine deposits. Lacustrine deposits occur as very fine sandy, clayey silt and silty clay. The lacustrine soil stratum above the till is as much as 30 feet thick. Lacustrine sediment permeability decreases with depth. The base of the till, which rests on shale bedrock, is as much as 65 feet below ground surface. Lacustrine sediments are exposed along the upper face of the steep bluff that prevails along the lake shore. (EH 2021a)

Soil units that occur within the PNPP property boundary are described in detail in Table 3.5-1 and shown in Figure 3.5-4. They are also summarized below. Approximately 99.78 percent of the site has soil cover. The remaining 0.22 percent of the area is covered in water. (USDA 2022c)

- Adrian muck
- Colonie loamy fine sand, 2-6 percent slopes
- Colonie loamy fine sand, 25-50 percent slopes
- Elnora loamy fine sand, 1-5 percent slopes
- Kingsville fine sand
- Lobdell silt loam
- Minoa fine sandy loam
- Stafford loamy fine sand
- Water

The PNPP site has been graded to approximate elevation 620 feet. The small stream between the plant and the bluff has been relocated and the abandoned channel (previously a U.S. Army Corps of Engineers (USACE) permitted Barge Slip) has been filled with compacted soils to elevation 620 feet. (EH 2021a)

Excavations for plant structures extend as deep as elevation 531 feet, which is within the Chagrin shale (EH 2021a). The plant excavations are backfilled to an elevation at least two feet above the top of the Upper Till with Class A fill and then to finished grade, elevation 620 feet, with Class B fill. Some Class C fill (non-safety) may be found between approximate elevation 615 feet and finished grade. (EH 2021a) Class A fill consists of clean, durable, free-draining sand and limestone gravel obtained from commercial quarries (EH 2021a). Class B fill was used for non-load bearing backfill around Seismic Category I structures. It consists of Lower Till soil that was removed and stockpiled during plant excavation. (EH 2021a) The total volume of the backfill around the plant island is conservatively calculated to be 11,340,000 cubic feet. (EH 2021a)

PNPP has a pressure relief underdrain system beneath the primary plant structures to reduce the hydrostatic pressure and increase the dynamic stability of the structures (EH 2021a). Porous concrete in the main plant area serves as a drainage medium to relieve hydrostatic pressures

(EH 2021a). Class A fill was placed above and beside the porous concrete wherever it would contact natural soil or Class B fill. Class A fill was designed and used to act as a filter blanket to protect the porous concrete from infiltration of fine particles present in the Class B fill and/or existing subsoils. It was also designed to serve as a drainage medium. Class A fill was placed over the perimeter areas of the porous concrete blanket to an elevation above the upper till to provide passage for the groundwater flow to the underdrain system. A minimum of two feet of Class A fill was placed against the outside building walls to act as a well drain. (EH 2021a)

3.5.3.2 Erosion Potential

Because PNPP has been operational since the early 1970s, stabilization measures are already in place to prevent erosion and sedimentation impacts to the site and vicinity. Stormwater runoff at PNPP is controlled by final site grading and the plant storm drain system. Based on information from the U.S. Department of Agriculture (USDA), all soil units listed in Table 3.5-1 subject to erosion have a slight to moderate erosion potential, except for Colonie loamy fine sand, 25 to 50 percent slopes, which has severe erosion potential. This soil comprises 5.83 percent of the mapped area and is mapped narrow bands along streams, along the bluff adjoining Lake Erie, and on the north side of the plant. (USDA 2022c)

PNPP maintains and implements a stormwater pollution prevention plan (SWPPP) that identifies potential sources of pollution reasonably expected to affect the quality of stormwater, such as erosion, and identifies practices to prevent stormwater runoff to Lake Erie. Stormwater runoff is controlled by site grading and the plant storm drain system. Stormwater runoff is collected in concrete catchment basins from graded yard areas, roof drains, oil interceptors with manually operated drain valves, containments surrounding the drains, and catch basins through system piping to headwalls that empty into three site streams. Sediment control dams are also used in the minor stream and northwest drain impoundments.

In addition, PNPP prevents bluff erosion along the lakefront with two interim revetments along the shoreline of the plant property. Protection is provided along the shoreline from the Remnant Minor Stream discharge to the Northwest Storm Impoundment Spillway. Protection is also provided at the outfall of the Diversion Stream. These two features are not continuous. (EH 2021c)

As discussed in Section 3.1.4, shoreline protection options are being evaluated for the northeast shoreline of Lake Erie within the site boundary. The potential project is funded for 2023 and installation may begin in 2024. As discussed in Section 3.2.1, Energy Harbor has a submerged land lease with the State of Ohio in place for approximately 3,500 feet of existing shoreline protection. In addition, PNPP updates the SWPPP, and best management practices (BMPs) as needed based on weekly site inspections. If spills or other areas of concern are identified, additional best management practices will be included to address each situation.

3.5.3.3 Prime Farmland Soils

The USDA's Natural Resources Conservation Service maps show that approximately 92.67 percent of the site are considered prime farmland (if drained or protected from flooding) or farmland of unique or statewide importance (USDA 2022c). These areas would most likely still be considered prime farmland even though they are part of the property owned by Energy Harbor. Even if areas of the property are designated prime farmland, PNPP would not be subject to the Farmland Protection Policy Act (FPPA) because the Act does not apply to federal permitting or licensing for activities on private or nonfederal lands. Soil units designated as prime farmland are identified in Table 3.5-1.

3.5.4 Seismic History

The magnitude of a seismic event is described by two methods: the modified Mercalli (MM) intensity scale and the Richter magnitude scale. The MM intensity is an estimate of the amount of damage caused at a site by an earthquake. The Richter magnitude scale is an approximate measure of the total amount of energy released by an earthquake. Accurate locations for earthquake epicenters have been available since the installation of modern seismographs in the region. Without seismographs, earthquakes were described using the MM intensity.

No physical evidence was uncovered during the geologic investigations of the surficial or subsurface materials that would indicate any correlation between historical earthquake activity and site geologic structure (EH 2021a).

Pleistocene glaciation induced localized shallow faults and folds in the shale strata beneath the site. Last movement on an offshore fault intersecting the cooling water tunnels occurred during Pleistocene time in response to deglaciation-isostatic rebound. (EH 2021a)

PNPP is in the central part of the Eastern Stable Platform tectonic province. Geologically, the province consists of highly deformed Precambrian basement of Grenvillian age, which is overlain unconformably by generally undeformed Cambrian through Permian shales, sandstones, and carbonates. The western boundary of the Eastern Stable Platform is defined by the coincidence of structures in the Paleozoic rocks and in part by the subsurface trace of the Grenville Front, where low angle thrust faulted metamorphic rocks of Grenvillian age abut essentially undeformed unmetamorphosed granites, rhyolite, and supracrustal continental deposits of Elsonian (1,450 million years ago) and Keweenawan (about 1,100 million years ago) ages. The northern boundary of the province is marked by west-northwest-trending block faulting in the Ottawa-Bonnechere graben in south-central Ontario, Canada. The southern boundary is defined by the eastward-trending Kentucky River fault zone and underlying Rome trough. The eastern margin of the province is transitional and is placed along the zone where northeastward-trending folding and east over west thrust faulting become apparent in sedimentary formations of the Appalachian Plateau. (EH 2021a)

Within 200 miles of PNPP, the following tectonic provinces or parts of tectonic provinces are found: the Eastern Stable Platform (site province), the Michigan Basin, Central Province, Appalachian Plateau province, and the Northern Valley and Ridge Province (EH 2021a). PNPP is in the Eastern Stable Platform Province, where seismic activity is relatively low. Within 200 miles of the site, only two zones of moderate seismic activity can be found. The first is located 160 miles away, in the same province, and is correlated to the Clarendon-Linden structure, while the second, in the Central Province, about 185 miles away near Anna, Ohio, is probably tied to local basement structures in that area. Within this context, the earthquake potential at the site is low, as related to the hypothetical occurrence of an Intensity VI (MM). Such an intensity is estimated from the maximum earthquake, not correlated to structure, experienced in the site province. (EH 2021a)

- The Eastern Stable Platform province is generally characterized by a crystalline basement terrane of metamorphic, sedimentary, and igneous rocks that last consolidated to a crustal block during the Grenvillian orogeny (1,100 to 900 million years ago). The surface of the crystalline basement slopes gently to the southeast from a series of elongated topographic arches along the western part of the province and is buried beneath a southeast-thickening, little-deformed sequence of Paleozoic sedimentary formations of platform derivation. Precambrian northwestward low-angle thrust faults, locally reactivated as normal faults offset down to the southeast, extend from the eastern boundary of the province to the Grenville Front on the west. The only faulting in the province that are assumed to be active is on the Clarendon-Linden fault zone near Attica, New York. No capable faults or evidence for young deformation or Quaternary movement have been reported. (EH 2021a)
- The Michigan Basin is a broad, shallow structural depression that underlies the lower Michigan peninsula, part of the Upper Peninsula, eastern Wisconsin, northern Illinois, Indiana, Ohio, and southwestern Ontario. Precambrian basement surface is overlain by a maximum of 14,000 feet of Paleozoic sediments (Cambrian-Pennsylvanian). (EH 2021a)
- The Appalachian Plateau province in the site region is a broad synclinal basin feature characterized by Grenvillian-age basement overlain unconformably by a thick section of moderately folded Upper Paleozoic red shale and sandstone overlying Lower Paleozoic shales, carbonates, and sandstones (EH 2021a).
- The Northern Valley and Ridge province in the site region consists of very deeply buried, metamorphosed, Grenvillian-age, Precambrian basement overlain by a thick section of Paleozoic sedimentary rocks. The Paleozoic rocks have been deformed into a series of north-northeastward trending, steeply inclined to overturned folds and associated southeastward-dipping thrust faults. (EH 2021a)
- The Central Province is characterized by a Precambrian basement terrane of essentially unmetamorphosed, predominantly felsic, igneous rocks of Elsonian age (about 1,450 million years ago). The surface of the crystalline basement over a wide area is nearly horizontal to gently southward-dipping and is buried beneath a thin cover of relatively little-deformed flat-lying Paleozoic sedimentary formations of platform derivation. Within

200 miles of the site, the only faulting in the Central Province believed to possibly be active is in the vicinity of Anna, Ohio, where two north-northeastward trending normal faults and one northwestward trending normal fault have been mapped on the basis of subsurface data. (EH 2021a)

Several faults and groups of faults have been defined within the site region: the Chatham Sag faults; the Peck fault and faults associated with the Howell-Northville anticline; the Bowling Green fault; faults near Anna, Ohio; faults along the Cincinnati arch; faults in eastern Ohio; western New York faults; and the Appalachian Plateau and Northern Valley and Ridge faults. Of these faults, the Clarendon-Linden fault system, located in western New York, 165 miles northeast of PNPP, is currently considered active, and a spatial correlation of earthquakes with the Anna-Champaign, Auglaize and Logan-Hardin faults in west-central Ohio has been suggested. (EH 2021a) The Clarendon-Linden fault system is a north trending zone of folds and faults that have been identified based on subsurface geological data. It deforms rocks of Devonian age and older. (EH 2021a)

No capable faults, with the possible exception of the Clarendon-Linden fault zone near Attica, New York, have been identified within the site region (EH 2021a). The highest seismic intensity observed or estimated for the vicinity of PNPP resulting from known earthquake activity is Modified Mercalli V. The level is believed to have occurred during the largest of the New Madrid earthquakes on February 7, 1812. (EH 2021a) A magnitude 5.0 short-period surface wave (mblg) earthquake occurred on January 31,1986 approximately 16.84 kilometers (km) from PNPP in Chardon, Ohio (EH 2021a). Earthquake epicenter locations of seismic events greater than intensity IV/magnitude 3.0 within a 200-mile (322-km) radius of PNPP from 1970 through February 2022 are listed in Table 3.5-2 and shown in Figure 3.5-5 (USGS 2022a). Three of the seismic events that occurred were caused by mining explosions or rock bursts.

The U.S. Geological Survey's (USGS) national seismic hazard map shows that the PNPP site is in a region with a 2 percent in 50 years (once in 2,500 years) probability of exceeding a peak ground acceleration between 0.12 and 0.2g (USGS 2015).

Table 3.5-1 Onsite Soil Unit Descriptions (Sheet 1 of 4)

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
Ad	Adrian muck	The Adrian component makes up 1.28 percent of the map unit. Slopes are 0-2 percent. This component is on depressions. The parent material consists of organic material. Depth to a restrictive layer is more than 80 inches. The drainage class is very poorly drained. Water movement in the most restrictive layer is moderately high to high. Available water to a depth of 10.7 inches is high. Runoff class is negligible. This soil is not flooded. It is not ponded. The frost-free period is 140 to 195 days. Depth to the water table is 0-12 inches. Non-irrigated land capacity classification is 4w. The soil meets hydric criteria. Erosion potential is slight.	Not prime farmland
CoB	Colonie loamy fine sand, 2-6 percent slopes	The Colonie component makes up 1.17 percent of the map unit. Slopes are 2-6 percent. This component is on beach ridges. The parent material consists of beach sand and/or sandy eolian deposits. Depth to a restrictive layer is more than 80 inches. The drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high to very high. Available water to a depth of 4.3 inches is low. Runoff class is negligible. This soil is not flooded. It is not ponded. The frost-free period is 140 to 195 days. Depth to the water table is more than 80 inches. Non-irrigated land capacity classification is 3s. The soil does not meet hydric criteria. Erosion potential is moderate.	Farmland of unique importance

Table 3.5-1 Onsite Soil Unit Descriptions (Sheet 2 of 4)

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
CoF	Colonie loamy fine sand, 25-50 percent slopes	The Colonie component makes up 5.83 percent of the map unit. Slopes are 25-50 percent. This component is on lake plains, dunes, outwash plains, and beach ridges. The parent material is glaciolacustrine deposits. Depth to a restrictive layer is more than 80 inches. The drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high to very high. Available water to a depth of 4.3 inches is low. Runoff class is low. This soil is not flooded. It is not ponded. The frost-free period is 140 to 195 days. Depth to the water table is more than 80 inches. Non-irrigated land capacity classification is 7e. The soil does not meet hydric criteria. Erosion potential is severe.	Not prime farmland
EnB	Elnora loamy fine sand, 1-5 percent slopes	The Elnora component makes up 28.58 percent of the map unit. Slopes are 1-5 percent. This component is on depressions on relict longshore bars and beach ridges. The parent material consists of glaciolacustrine deposits. Depth to a restrictive layer is greater than 80 inches. The drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 3.9 inches is low. Runoff class is very low. This soil is not flooded. It is not ponded. The frost-free period is 140 to 195 days. Depth to the water table is about 18 to 24 inches. Non-irrigated land capacity classification is 2w. The soil does not meet hydric criteria. Erosion potential is moderate.	Farmland of statewide importance
Kf	Kingsville fine sand	The Kingsville component makes up 11.84 percent of the map unit. Slopes are 0-2 percent. This component is on beach ridges. The parent material consists of glaciolacustrine deposits. Depth to a restrictive layer is greater than 80 inches. The drainage class is very poorly drained. Water movement in the most restrictive layer is high to very high. Available water to a depth of 5.6 inches is low. Runoff class is negligible. This soil is not flooded. It is frequently ponded. The frost-free period is 140 to 195 days. Depth to the water table is about 0 to 12 inches. Non-irrigated land capacity classification is 4w. The soil meets hydric criteria. Erosion potential is slight.	Farmland of statewide importance

Table 3.5-1 Onsite Soil Unit Descriptions (Sheet 3 of 4)

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
Lb	Lobdell silt loam	The Lobdell component makes up 4.54 percent of the map unit. Slopes are 0-2 percent. This component is on floodplains. The parent material consists of alluvium. Depth to a restrictive layer is greater than 80 inches. The drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high to high. Available water to a depth of 9.0 inches is moderate. Runoff class is low. This soil is frequently flooded. It is not ponded. The frost-free period is 133 to 195 days. Depth to the water table is about 18 to 36 inches. Non-irrigated land capacity classification is 2w. The soil does not meet hydric criteria. Erosion potential is slight.	Prime farmland if protected from flooding or not frequently flooded during the growing season
Mo	Minoa find sandy loam	The Minoa component makes up 30.02 percent of the map unit. Slopes are 0-2 percent. This component is on lake plains. The parent material consists of glaciolacustrine deposits. Depth to a restrictive layer is more than 80 inches. The drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high to high. Available water to a depth of 9.7 inches is high. Runoff class is low. The soil is not flooded. It is not ponded. The frost-free period is 140 to 200 days. Depth to the water table is about 6 to 18 inches. Non-irrigated land capacity is 3w. The soil does not meet hydric criteria. Erosion potential is slight.	Prime farmland if drained

Table 3.5-1 Onsite Soil Unit Descriptions (Sheet 4 of 4)

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
St	Stafford loamy fine sand	The Stafford component makes up 16.52 percent of the map unit. Slopes are 0-2 percent. This component is on barrier beaches and beach ridges. The parent material consists of glaciofluvial deposits. Depth to a restrictive layer is more than 80 inches. The drainage class is somewhat poorly drained. Water movement in the most restrictive layer is high to very high. Available water to a depth of 2.8 inches is very low. Runoff class is very low. The soil is not flooded. It is not ponded. The frost-free period is 140 to 195 days. Depth to the water table is about 6 to 18 inches. Non-irrigated land capacity classification 3w. The soil does not meet hydric criteria. Erosion potential is slight.	Farmland of unique importance
W	Water	Water makes up 0.22 percent of the map unit.	Not prime farmland

(USDA 2022c)
a. See Figure 3.5-4 for map unit symbols.

Table 3.5-2 Historic Seismic Events of Magnitude 3.0 Mb or Greater within 200 miles of PNPP, 1970–2022[(a)] (Sheet 1 of 3)

Earthquake Date	Local Time	Latitude	Longitude	Magnitude	Distance from PNPP (miles/km)	Approximate Location
9/28/1974	9:26 PM	41.238	-83.361	3 lg	121/195	6 km ESE of Risingsun, Ohio
10/20/1974	10:13 AM	39.095	-81.593	3.4 lg	188/303	11 km SSW of Mineral Wells, West Virginia
2/2/1976	4:14 PM	41.96	-82.67	3.4 lg	79/128	11 km SSW of Leamington, Canada
6/17/1977	10:39 AM	40.707	-84.582	3.2	194/313	5 km ENE of Rockford, Ohio
8/20/1980	4:34 AM	41.941	-83.01	3.2	97/156	19 km SSE of Amherstburg, Canada
8/28/1981	5:51 AM	43.21	-80.57	3.3 mblg	102/163	11 km SSE of Plattsville, Canada
9/5/1981	12:49 AM	42.73	-81.35	3.1 mblg	65/105	13 km WNW of Port Stanley, Canada
10/4/1983	12:18 PM	43.44	-79.79	3.1 mblg	132/213	7 km NNE of Burlington, Canada
1/31/1986	11:46 AM	41.65	-81.162	5 mw	10/17	4 km NNW of Chardon, Ohio
7/12/1986	3:19 AM	40.537	-84.371	4.5 mb	190/305	1 km ESE of Saint Marys, Ohio
7/13/1987	12:49 AM	41.896	-80.767	3.5 mb	20/33	2 km N of Edgewood, Ohio
7/13/1987	2:52 AM	41.9	-80.8	3 mblg	19/31	3 km NW of Edgewood, Ohio
7/23/1987	4:32 AM	43.491	-79.472	3.4 mblg	144/232	12 km SSE of Long Branch, Canada
5/28/1988[(b)]	11:18 AM	39.753	-81.613	3.4 mblg	143/231	6 km SW of Belle Valley, Ohio
8/5/1989	4:07 PM	43.21	-79.53	3.3 mblg	127/205	12 km WNW of Vineland, Canada
1/25/1991	10:21 PM	41.536	-81.453	3.4 mblg	24/39	1 km NNE of Mayfield Heights, Ohio
8/15/1991[(c)]	2:16 AM	40.786	-77.657	3 mblg	194/313	7 km SSE of Centre Hall, Pennsylvania
3/15/1992	1:13 AM	41.911	-81.245	3.5 mblg	9/15	15 km NW of North Perry, Ohio
10/16/1993	1:30 AM	41.698	-81.012	3.6 mblg	10/16	8 km SSE of Madison, Ohio
3/12/1994[(c)]	5:43 AM	42.782	-77.876	3.6 mblg	181/291	0 km NW of Cuylerville, New York
9/2/1994	4:23 PM	42.798	-84.604	3.5 mblg	190/306	5 km SSW of DeWitt, Michigan

Table 3.5-2 Historic Seismic Events of Magnitude 3.0 Mb or Greater within 200 miles of PNPP, 1970–2022[(a)] (Sheet 2 of 3)

Earthquake Date	Local Time	Latitude	Longitude	Magnitude	Distance from PNPP (miles/km)	Approximate Location
5/25/1995	9:22 AM	42.995	-78.831	3 mblg	144/232	3 km NW of Amherst, New York
9/25/1998	2:52 PM	41.495	-80.388	4.5 mwc	44/71	2 km SW of Adamsville, Pennsylvania
11/26/1999	5:33 PM	43.71	-78.997	3.8 mblg	171/275	14 km ESE of Centennial Scarborough, Canada
5/24/2000	5:22 AM	43.806	-79.099	3.1 mblg	173/278	4 km ENE of Centennial Scarborough, Canada
1/25/2001	10:03 PM	41.942	-80.802	3.9 mb	20/32	8 km NNW of Edgewood, Ohio
2/3/2001	3:15 PM	42.345	-77.394	3.2 mblg	196/316	6 km W of Bath, New York
6/3/2001	5:36 PM	41.905	-80.767	3.4 mblg	21/33	3 km N of Edgewood, Ohio
6/30/2003	2:21 PM	41.8	-81.2	3.6 mblg	3/5	6 km NW of Perry, Ohio
6/29/2004	11:03 PM	41.78	-81.08	3.3 mblg	4/6	2 km WNW of Madison, Ohio
8/4/2004	6:55 PM	43.6955	-78.254	3 md	197/317	30 km SSW of Cobourg, Canada
3/11/2006	7:27 AM	41.78	-81.39	3.1 mblg	13/21	8 km NNW of Mentor-on-the-Lake, Ohio
6/20/2006	3:11 PM	41.84	-81.23	3.5 mwr	5/8	9 km WNW of North Perry, Ohio
3/12/2007	6:18 PM	41.28	-81.38	3.7 mblg	38/61	Ohio
10/17/2007	3:04 PM	41.75	-81.42	3.4 mblg	15/24	7 km NW of Mentor-on-the-Lake, Ohio
1/8/2008	8:34 PM	41.72	-81.43	3.1 mblg	16/25	6 km WNW of Mentor-on-the-Lake, Ohio
4/24/2010	9:00 PM	41.78	-81.08	3 mblg	4/6	2 km WNW of Madison, Ohio
2/23/2011	9:21 AM	42.157	-82.43	3 mblg	71/114	18 km NE of Leamington, Canada
6/5/2011	10:35 AM	41.03	-82.08	3 mblg	72/116	5 km W of Lodi, Ohio
8/31/2011	12:36 PM	39.51	-81.47	3.1 mblg	159/256	3 km SE of Lowell, Ohio

Table 3.5-2 Historic Seismic Events of Magnitude 3.0 Mb or Greater within 200 miles of PNPP, 1970–2022[(a)] (Sheet 3 of 3)

Earthquake Date	Local Time	Latitude	Longitude	Magnitude	Distance from PNPP (miles/km)	Approximate Location
12/31/2011	3:05 PM	41.1215	-80.6843333	4 ml	53/85	3 km NW of Youngstown, Ohio
7/1/2013	2:48 AM	41.793	-81.292	3.2 mblg	8/12	5 km NNW of Fairport Harbor, Ohio
11/20/2013	12:59 PM	39.445	-82.205	3.5 mb_lg	172/277	2 km SW of Buchtel, Ohio
2/12/2014	11:57 PM	43.64	-78.3958333	2.46 ml	189/304	34 km N of Lyndonville, New York
4/2/2017	6:58 AM	39.6644	-81.2434	3 mb_lg	147/237	5 km W of Graysville, Ohio
5/24/2017	11:24 AM	39.2296	-82.4759	3.4 mb_lg	191/307	1 km S of McArthur, Ohio
6/2/2017	10:08 PM	39.9166	-81.2934	3.4 mwr	130/210	1 km WNW of Batesville, Ohio
4/19/2018	7:01 PM	42.1181	-83.015	3.4 mwr	99/159	Michigan
5/8/2018	4:27 PM	43.7347	-78.949	3 mb_lg	174/280	14 km SSE of Ajax, Canada
6/10/2019	9:50 AM	41.6797	-81.4564	4 mb	18/29	1 km NW of Timberlake, Ohio
8/21/2020	5:55 PM	41.9125	-83.3179	3.2 mwr	112/181	2 km SSE of Detroit Beach, Michigan

(USGS 2022a)

[a] All seismic events within 200 miles (322 km) with a Richter magnitude of greater than 3.0.
[b] Seismic event caused by explosion
[c] Seismic event caused by rock burst
mb = Short-period body wave
mblg, mb_lg, lg = Short-period surface wave
md = Duration
ml = Local
mw = Moment W-phase
mwc = Centroid
mwr = Regional

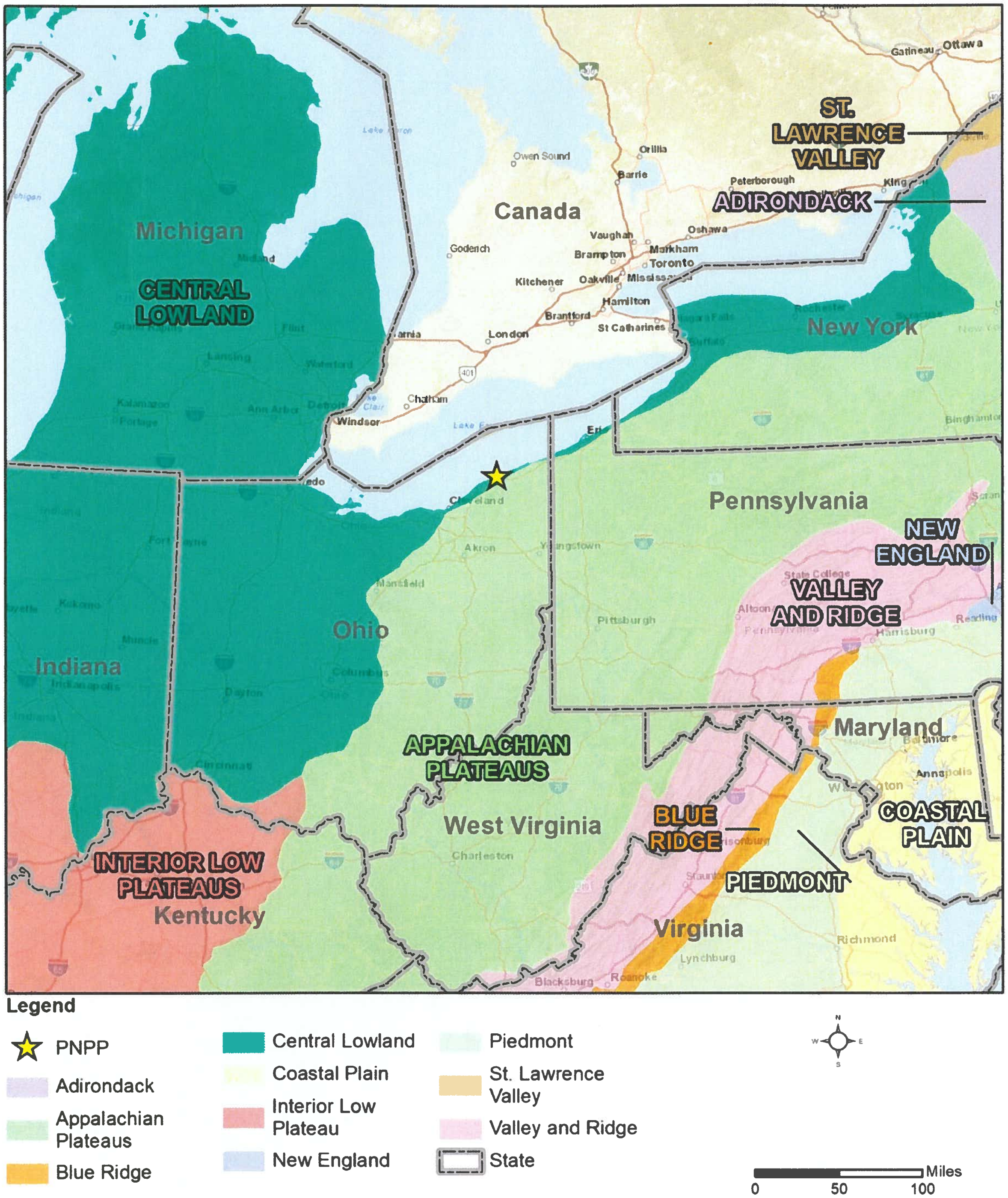


Figure 3.5-1 Physiographic Provinces Associated with PNPP

Figure 3.5-2 Bedrock Geology Map, PNPP Property

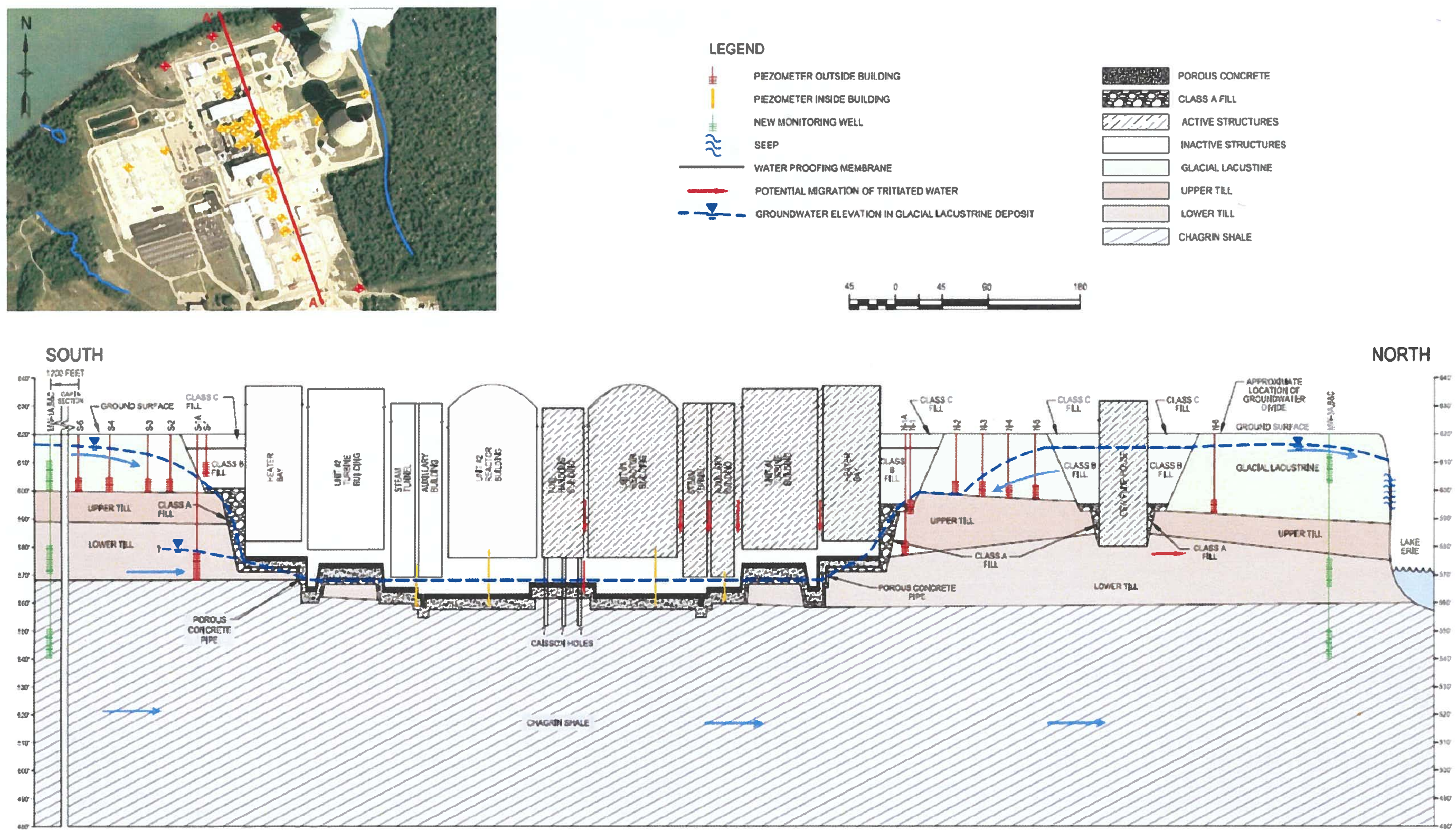


Figure 3.5-3 Geologic Cross-Section and Location at PNPP

Note: The figure does not reflect the actual lower elevations of the turbine/turbine power and heater bay buildings, which are at 548 and 542 feet.

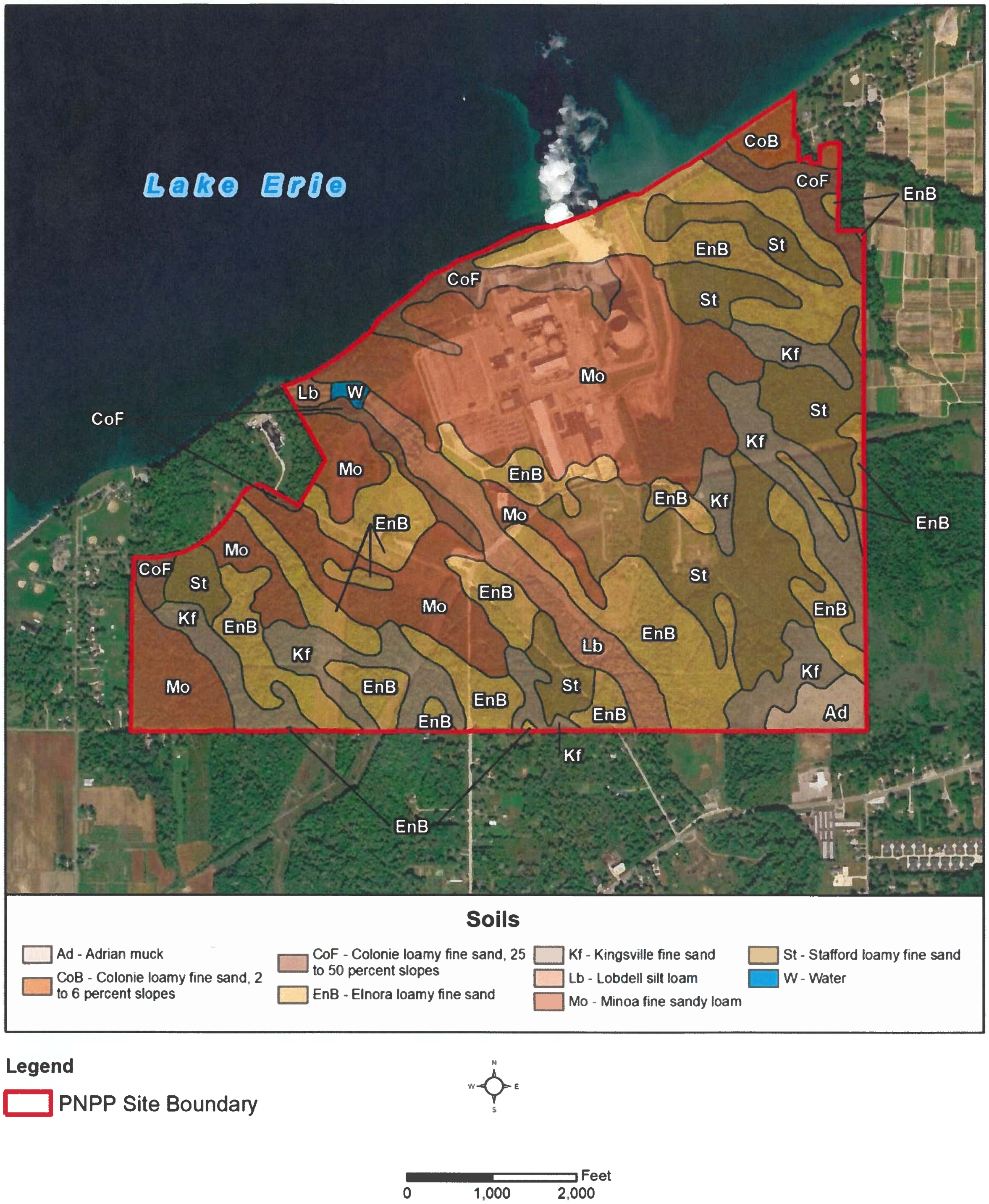


Figure 3.5-4 Distribution of Soil Units, PNPP Property

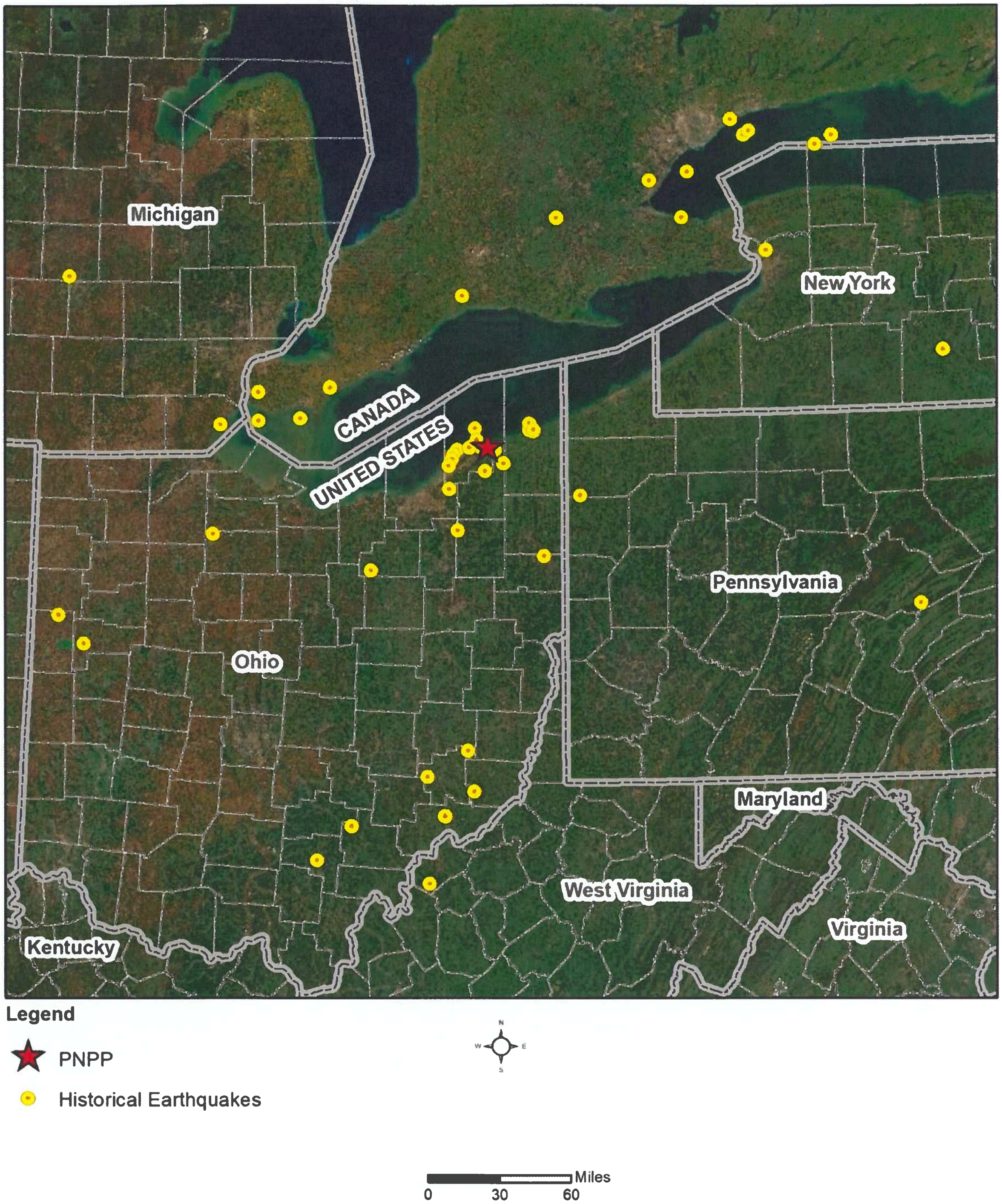


Figure 3.5-5 Historical Seismic Events, 1970–2022

3.6 Water Resources

3.6.1 Surface Water Resources

PNPP is in Lake County, Ohio, approximately 7 miles northeast of Painesville, the county seat, and 35 miles northeast of Cleveland, the nearest large principal city (Figure 3.1.3). The eastern two thirds of the site is within the boundaries of North Perry and the western third is within Perry TWP. (EH 2021a) The plant site, which is approximately 1,030 acres in size and relatively flat, is located along the southeastern shoreline of Lake Erie on an ancient lake plain approximately 50 feet above lake low water datum. The land has a very gentle slope toward the lake and is incised by small streams that drain into the lake. (EH 2021a) Lake Erie is the major hydrological feature in this location (Figure 3.6-1) (EH 2021a).

Lake Erie has an area of 9,970 square miles. It is the shallowest of the Great Lakes with a maximum depth of 210 feet and an average depth of 58 feet. Lake Erie has the smallest volume of the Great Lakes, 110 cubic miles. The lake is about 241 miles long with a maximum width of 57 miles. The long axis of the lake lies in a general northeast-southwest direction. The drainage basin of Lake Erie, including Lake St. Clair, is about 29,650 square miles. (EH 2021a)

The National Oceanic and Atmospheric Administration (NOAA) monitors variations in the water levels of Lake Erie via a series of lake gauges. Lake Erie water levels are available from a permanent gauge in Cleveland, Ohio (ID #9063063) January 17,1935, through December 2021. During this time, the minimum water level was 566.31 feet msl in February 1936, and the maximum water level was 575.34 feet msl in July 2020. The 86 years of water level data indicate the maximum water level change at the Cleveland gauge was 9.03 feet. (NOAA 2022b) A summary of Lake Erie water level data is included in Table 3.6-1.

Service and makeup water for the power plant are obtained from Lake Erie (EH 2021a). The intake structures from PNPP are located approximately 2,600 feet offshore perpendicular from the shoreline. The discharge structure is approximately 1,650 feet offshore. These structures are in 20 to 23 feet of water at a minimum of 12 feet below the lake low water datum. (EH 2021a)

The main intake structures consist of two independent intake heads that are each connected to a 6-foot diameter shaft. Inflow is through vertical openings around the periphery of the intake heads. The discharge structure consists of one 3-foot diameter diffuser nozzle encased in a 17-foot diameter protective concrete caisson. The intake and discharge structures are separated by approximately 1,550 feet of horizontal separation. (EH 2021a) The intake and discharge structures are described further in Section 2.2.

The surface water characteristics of PNPP are not influenced by Lake Erie since the mean lake level is more than 40 feet below plant grade. Near PNPP, the coastal watershed is drained by several small streams. These streams have cut deep channels as they approach the lake in the otherwise flat terrain of this region. The width of this coastal watershed in the site area is approximately 4.5 miles with the ground falling away sharply to the south of the ridge into the Grand River Basin. (EH 2021a)

Two parallel streams run close to the PNPP area. The larger stream, called the Major Stream, has a drainage basin of 7.44 square miles and runs northwestward within 1,000 feet of the southwest corner of PNPP. The smaller stream, called the Diversion Stream, which has a drainage area of only 0.59 square miles, borders the PNPP area to the east. The smaller stream was originally diverted prior to construction and had been historically referred to as the Minor Stream. The name change to the Diversion Stream coincides with a post-construction modification to divert the stream farther to the east. A portion of the originally engineered channel of the Minor Stream remains located between the plant area and the Diversion Stream. This section of the stream no longer functions as a traditional stream. The "Remnant Minor Stream," as it is now named, functions as a drainage swale. (EH 2021c) The safety-related structures of PNPP are located between the watersheds of the adjacent streams. PNPP is not subject to flooding from surface runoff originating from either stream's drainage basin. Site drainage ultimately is directed to Lake Erie either directly or via the following notable drainage paths: ESW Swale, Remnant Minor Stream, Major Stream, the Barge Slip, and the Northwest Impoundment. No recorded data exists for either of the adjacent streams. However, base flow estimates indicate that the average flow for the Major and Diversion streams would be approximately five cubic feet per second (cfs) and 0.78 cfs, respectively. (EH 2021c)

The closest known water intake structure on Lake Erie is located at the inoperative IRC Fiber plant, about 3.5 miles west-southwest of the plant center. The closest shipping channel is approximately 2 miles from the PNPP center with a depth of approximately 40 feet. It parallels the Ohio coastline between the ports of Fairport Harbor and Ashtabula. (EH 2021a)

3.6.1.1 Potential for Flooding

The southern plant site boundary line is 3,100 feet from the shoreline of Lake Erie on the west side of the site and 8,000 feet on the east side. Grade elevations in the immediate plant area prior to plant construction varied between 620 feet and 623 feet based upon the USGS datum. The maximum monthly average level of record for Lake Erie is 575.4 feet based on USGS datum; therefore, no problems of site flooding exist due to elevated lake levels. The construction of the plant resulted in changes in local drainage patterns, runoff characteristics, and in the modification of two streams located on the plant property. (EH 2021c)

Potential sources of flooding at PNPP include Lake Erie, to the north of the plant, flooding by the Major Stream, which borders PNPP to the west and south, flooding from the Diversion Stream, which borders PNPP to the east, and flooding due to direct precipitation events. All flooding sources are mitigated with unique flooding protection to ensure that floodwaters do not adversely impact safety-related structures, systems, and components. Protection is provided in the form of exterior barriers and incorporated barriers. (EH 2021c). No records of flooding in the plant area of the site exist, either from the two adjacent streams draining the coastal watershed or from Lake Erie. The terrain is relatively flat and gently sloping toward the lake. The soil is relatively permeable and contains sand layers in the upper reaches of the drainage area. Flood hazard analyses, however, are conservative and assume no soil infiltration due to the impervious surface materials. The ground surface in much of the catchment area is forested with a heavy mulch ground cover. Due to the flat terrain, permeable upper soil layers and the small catchment areas, it is unlikely that this location has ever been subjected to flooding or will experience severe flooding from surface runoff in the future. (EH 2021c)

Flooding from Lake Erie is extremely improbable. Final grade elevations in the immediate plant area vary from 617 to 620 feet. This is about 45 feet above the maximum monthly mean lake level of 575.4 feet. (EH 2021a) Maximum lake levels occur in mid-summer when the full effect of the runoff from the drainage basin is felt. Fluctuations of several feet, but of short duration, are caused by wind effects. Northerly winds raise lake levels in the plant area while winds from the south and east tend to lower the lake levels. (EH 2021a)

Based on Federal Emergency Management Agency (FEMA) data, the PNPP property is in an area of minimal flood hazard. The Major Stream, on the south side of PNPP, is mapped as Zone A, which corresponds with the 100-year floodplain. The Lake Erie shoreline is mapped as Zone VE, a coastal area with a 1 percent or greater chance of flooding and an additional hazard associated with storm waves. (Figure 3.6-2)

The onsite drainage system, discussed in Section 3.6.1.2.2, is designed to remove the water resulting from peak rainfall intensity of 13.19 inches per hour during the first hour and total precipitation of 34.72 inches over 48 hours. The storm drain system was designed to reduce the effects of the local intense precipitation flooding event, but it is not capable of preventing floodwater accumulation. (EH 2021c)

3.6.1.2 Surface Water Discharges

3.6.1.2.1 NPDES-Permitted Outfalls

Chemical additives approved by the OEPA are used to control pH, scale, and corrosion in the circulating water system, and to control biofouling of plant equipment. A liquid biocide injection system is used, as required, to minimize algae and plant growth (EH 2021a). Process wastewaters are monitored and discharged to Lake Erie via NPDES outfalls in accordance with the PNPP NPDES Permit No. 3IB00016*LD. The current NPDES permit authorizes discharges from three outfalls, one external (Outfall 004/094) and two internal (Outfalls 601 and 603). Outfall 094 is the same location as Outfall 004, which is the final effluent point representative of the discharge to Lake Erie. Sampling at Outfall 094 is required if there is chlorination or bromination of more than 120 minutes per day. The NPDES outfalls are active process discharges that flow into Lake Erie and are depicted in Figure 3.6-3. Their associated effluent limits are listed in Table 3.6-2.

Three surface impoundments for stormwater management are included in the NPDES permit: a major stream impoundment, a northwest storm drainage impoundment, and a minor stream impoundment. The impoundments are further described in the following subsection 3.6.1.2.2.

3.6.1.2.2 Stormwater Runoff

Stormwater runoff at PNPP is controlled by final site grading and the plant storm drain system. These features were designed to prevent potential flooding of site facilities and minimize the potential for discharging spilled oil to Lake Erie.

The storm drain and sewer system collect water runoff from the ground, roof drains, and transformer oil interceptor tank (except for the miscellaneous oil interceptor tank, which drains to the sludge holding sump). Surface drainage is provided by a combination of overland drainage features and the site's storm drain system. Site topography provides overland runoff to several notable drainage features, including the Major Stream, Remnant Minor Stream via the ESW swale, the Barge Slip, Northwest Impoundment, and Lake Erie. Additionally, three separate subsurface storm drainage systems (East, West, and South System) assist in surface drainage. Site topography and the storm drain system are designed to reduce the effects of the local intense precipitation flooding event. The controlling flood levels impacting the site surface drainage ability is largely influenced by site topography and ground cover type; location and dimensions of above grade objects, structures, and buildings; roof drainage and storage; surface drainage features; and subsurface storm drain systems. Due to drainage limitations, floodwater depths have the potential to impact structures. (EH 2021c)

Sixty concrete catch basins located throughout PNPP collect storm runoff. The concrete catch basins located throughout PNPP collect runoff from the ground, roof drains, and transformer interceptor tanks (except for the miscellaneous oil interceptor tank, which drains to the sludge holding sump). The water drains by gravity through system piping to the headwalls in the sediment ponds or small stream diversion. From there, it drains to Lake Erie. The catch basins are divided into the east, west, and south groups. Three concrete/riprap headwalls admit a flow of storm drainage to one of two sediment ponds or to the small stream diversion. The headwall allows incoming drainage to disperse and filter through riprap before being released to the lake. (EH2021a)

A bioretention area was installed in 2010 in the west parking lot located north of the transmission yard as a BMP to reduce stormwater runoff. After the ISFSI pad was constructed, the Lake County Soil & Water Conservation District recommended a bioretention area to store and treat stormwater runoff. In a bioretention area, surface runoff is directed into shallow, landscaped depressions designed to remove pollutants using plants, mulch or ground cover, and engineered soil mix. The installed system includes a catch basin measuring 357.5 feet by 217 feet with layers of gravel, soil mix, and mulch. Perforated PVC pipes runs through the bioretention area and drain to a PVC pipe below the bioretention basin westward to a storm drain headwall that discharges to the Major Stream and eventually to Lake Erie. The industrial waste lagoons receive rainwater and reverse osmosis reject water from the reverse osmosis unit. There are no chemicals added to this waste stream. The chemical cleaning lagoon has been used to store ESW forebay silt. The Unit 2 cooling tower basin has also been used to store the ESW forebay silt.

Water from the eastern side of the power block discharges to the minor stream east of the cooling towers. In 2015, PNPP completed a large-scale construction project to relocate the minor stream farther into the forested wetland and to deepen the channel. Precipitation excess from the northwestern and western side of the power block is collected by the west storm drain system and is discharged at the northwest impoundment, west of the industrial waste lagoons. Precipitation excess from the south of the power block is collected by the storm drain system and carried to the system headwall, which discharges along the east bank of the Major Stream. Precipitation excess from the east side of the power block is collected by the east storm drain system and carried to the system headwall, which discharges along the west bank of the Remnant Minor Stream. (EH 2021c)

The northwest impoundment is a non-safety-related sediment control earthen dam and associated concrete spillway at the northwest corner of the plant site. The toe of the spillway is approximately 90 feet south of the 1975 shoreline. The channel bottom between the spillway toe and the shoreline is protected by a 2.5-foot-thick riprap layer placed over a 1.25-foot-thick gravel filter. (EH 2021a)

There is insufficient time to allow significant drainage to infiltrate the underdrain system because of the impermeable surface materials. Rainfall on paved and unpaved areas around the main plant buildings is generally routed by topography or the storm drain system away from the plant. Rainwater or lawn sprinkling water that falls on unpaved areas and percolates into the backfill material around the main plant buildings will add an insignificant amount to the flow in the pressure-relief underdrain system. (EH 2021a, EH 2021c)

Stormwater discharges associated with PNPP industrial activities are regulated and controlled through NPDES Permit No. 3IB00016*LD issued by the OEPA. Energy Harbor also maintains and implements a SWPPP that identifies potential sources of pollution, such as erosion, which would reasonably be expected to affect the quality of stormwater and identifies BMPs that will be used to prevent or reduce the pollutants in stormwater discharges.

3.6.1.2.3 Sanitary Wastewaters

Sanitary wastewater is discharged offsite to the Lake County Department of Utilities. All sanitary wastewater has been routed offsite since the middle- to late-1980s.

During construction, the plant used an onsite sanitary wastewater treatment plant for the treatment and disposal of sewage. A lift station and forced main were installed to connect the plant to the Lake County Department of Utilities sanitary sewer system and the sanitary wastewater treatment plant was closed. PNPP had an industrial permit (No. 1004911) with the Lake County Department of Utilities effective September 1, 1994. In January 1999, First Energy requested termination of this permit stating that sanitary wastewater discharged from PNPP is generated from kitchens and restrooms and that PNPP does not discharge process wastewater.

In February 1994, the Lake County Department of Utilities removed PNPP from the classification of “significant” industrial user list and required quarterly sampling of sanitary wastewater for isotopic analysis. On May 27, 2003, the Lake County Department of Utilities approved semiannual sanitary wastewater sampling in June and December of each year.

Plant effluent is discharged to Lake Erie. All discharges are monitored and regulated under the NPDES Permit.

3.6.1.2.4 Dredging

No periodic maintenance dredging has occurred at PNPP and no dredging activities in the vicinity of the intake and discharge are anticipated. Should dredging become necessary, then it would be performed in accordance with appropriate regulatory permitting processes, including obtaining dredging permits from the USACE.

3.6.1.2.5 Compliance History

As presented in Chapter 9, there have been no NOVs associated with PNPP wastewater discharges to receiving surface waters over the five-year period of 2017 through 2021.

3.6.1.2.6 Lake Water Temperatures Reporting

PNPP measures cooling water discharge and intake water temperatures and the raw data are averaged for each month. The average temperature values for the discharge and intake for 2017 to 2021 are plotted in Figures 3.6-4 and 3.6-5, respectively.

In 1999, GE Nuclear Energy prepared a safety analysis report for PNPP's, 5 percent thermal power uprate. Lake Erie is the ultimate heat sink for PNPP. The service water system at PNPP was originally designed to support the operation of two units. Therefore, the design discharge temperature into Lake Erie is based on two-unit operation. It was concluded that there is a slight increase in the normal heat loads rejected to the plant service water system (0.34°F) resulting from a power uprate to 105 percent of the previous licensed core power. However, the NRC agreed that this increase in service water temperature does not exceed the original design discharge temperature. It was found that the temperature of Lake Erie is not affected by the power uprate despite the slight increase in service water temperature.

3.6.2 Groundwater Resources

3.6.2.1 Groundwater Aquifers

Glaciolacustrine deposits and till cover most of the surface in northeastern Ohio (EH 2021a). The surficial stratum of lacustrine sediments is the principal water-bearing zone at the plant site (EH2021a). Locally, the site is underlain by about 55 to 60 feet of lacustrine deposits and glacial till resting on a shale bedrock erosional surface that slopes gently toward Lake Erie (EH 2021a).

Lacustrine soils are somewhat poorly drained, fine-sandy loam. The sand and silt content varies both vertically and horizontally. Soil permeability is moderately low. The underlying dense, but relatively less permeable till acts as a barrier retarding the downward percolation of groundwater. Trafficability of the soil is very poor when wet. A high seasonal water table is the major limitation to the use of this soil. The soil, if drained, is suited for specialty crops, of which nursery stock is the most prevalent in the locale. Soils on some portions of the site have been reworked and seeded consistent with final grading and revegetation plans. (EH 2021a) As stated in Section 3.6.2.3, depth to groundwater in the glacial lacustrine deposit ranges from approximately four to 16 feet below ground surface. The current depth to groundwater within the glacial lacustrine deposit around the power block is highly influenced by the underdrain system.

A near-surface, fresh groundwater system exists within the glacial drift encountered throughout the PNPP site. Groundwater was observed to be held primarily within surficial lacustrine deposits, which are underlain by a very dense, relatively impervious clay till deposited as ground moraine. Owing to the low permeability of the predominately fine-grained soils, this water system has a very limited yield but has been used as a domestic water source. The relatively impervious Ohio Shale, over 1,100 feet thick, acts as an aquiclude that, together with the artesian heads of the underlying brine aquifers, prevents significant downward freshwater percolation. (EH 2021a)

Subsurface water accumulating above the till and within the glacial lacustrine deposit results in a semi-perched groundwater condition and represents the main water-bearing zone at PNPP. Permeable materials within the fine-grained lacustrine deposits are composed of thin layers (a few inches thick) of silty sand. Water levels in observation wells in the lacustrine deposits rise rapidly during and immediately after periods of precipitation then drop during dry periods. Little water is found in the glacial till overlying the shale. Locally, the shale bedrock receives only very small amounts of recharge because the till serves as a barrier to downward movement of water. The pre-construction piezometric groundwater surface was approximately three to five feet below the ground surface at the plant location. The contribution of groundwater from each geologic unit to the underdrain system is controlled by the relative hydraulic conductivity of each unit. The glacial lacustrine, upper, and lower till, and Chagrin Shale all have relatively low hydraulic conductivity. The glacial lacustrine deposit exhibits the highest relative hydraulic conductivity; therefore, the majority of groundwater entering the underdrain system originates from this unit. The power block excavations removed the upper and lower till, effectively resulting in the hydraulic connection of the glacial lacustrine deposit and the Chagrin Shale at the power block.

Observations made in the test borings at the site indicate groundwater levels usually ranging from three to five feet below ground surface in the main plant area with the depth gradually increasing to 11 feet in the close vicinity of Lake Erie. Within the plant area, the groundwater level was observed to generally range between elevations 613 and 624 feet. (EH 2021a) Wells penetrating the water table in glacial deposits frequently yield small amounts, generally less than 10 gpm. Small domestic supplies are available from glaciolacustrine deposits nearly everywhere in the region. (EH 2021a)

The southward-dipping bedrock underlying the glacial deposits is composed of thin-bedded medium gray shale with some thin, light gray fine-grained sandstone to siltstone layers. The bedrock is relatively impervious, except along joints and within the thin, weathered, and somewhat fractured zone near the bedrock/overburden contact. The amount of water these rocks yield is small, generally less than 5 gpm. (EH 2021a)

Recharge to the glacial deposits and bedrock is primarily by infiltration of precipitation. Downward infiltration is retarded in large part by the heterogeneous nature and low permeability of the glacial till. A minor amount of the infiltrating water eventually percolates to the underlying jointed bedrock. (EH 2021a)

Major rock aquifers have been identified within the area of study. The shallowest system (other than near-surface groundwater) is primarily associated with the Oriskany Sandstone ("First Water" of the "Big Lime") and is locally encountered at depths on the order of 1,600 feet. Occasional water-bearing zones have also been encountered near the base of the Columbus and in the upper part of the Bass Islands and Helderberg. The waters of these and deeper rock aquifers are a natural brine of high salinity, which represent solution remnants of water that filled interstices of sediments deposited in seas of Devonian and Silurian age. The Oriskany aquifer is under considerable artesian pressure and rises in communicating wells to within 100 to 150 feet of ground surface, and therefore has an excess pressure head of at least 1,450 feet. (EH 2021a)

The "Second Water" of the "Big Lime" is regionally encountered below the salt measures at a depth of about 2,600 feet and is associated with porous crystalline dolomite strata of the Lockport Group known as the Newburg Sand. Newburg water is a natural brine and is one of the chief water-bearing horizons in the deep-seated rocks. The great yield of this aquifer is consistent with artesian pressure sufficient to cause a rise of the brine in wells to within 300 feet of ground surface, demonstrative of an excess pressure head of 2,300 feet. (EH 2021a)

No aquifers have been locally identified either within the evaporite rocks or the overlying Devonian shales. It is again noted that evaporite rocks of the Salina have a very low porosity and permeability. (EH 2021a)

3.6.2.2 Hydraulic Properties

The rate of flow (velocity) of groundwater depends on the hydraulic conductivity, hydraulic gradient, and porosity of the medium through which it is moving.

The PNPP site geology is composed of four units consisting of the glacial lacustrine, upper till, lower till, and Chagrin Shale. The hydrogeologic description of each unit is described below.

- Glacial lacustrine – The shallowest unit that occurs naturally at ground surface, this deposit contains interbedded fine sand, clayey silt, and silty clay. The glacial lacustrine deposit represents sediments of a complex, unconsolidated nature that were deposited within a temporary lake during recession of glacial ice from Lake Erie. Average horizontal permeability measured during construction were low, ranging from 1.2×10^{-4} to 4.2×10^{-7} cm/s with an estimated mean value of approximately 1.0×10^{-5} cm/s.

- Upper Till – Located beneath the glacial lacustrine deposit, the upper till consists of grey, massive, and firm clay with some silt. The upper till is present across PNPP, except where it is excavated below the power block. The upper till lies over an erosional surface on the underlying lower till. The unit is very dense, relatively impervious, and acts as a retarding barrier to downward infiltration of precipitation.
- Lower till – Located beneath the upper till deposit, the lower till consists of a grey, massive, and firm clay with some silt. The lower till is differentiated from the upper till by firmer materials. The lower till is also present across the site, except where it is excavated below the power block. The base of the lower till was historically characterized to include a boulder layer, described as a 1-foot-thick layer of rounded boulders up to 1-foot in diameter.
- Chagrin Shale – Located beneath the lower till, the Chagrin Shale consists of bluish-grey, clayey, and sandy shale. The shale is moderately hard with the natural surface of the Chagrin Shale sloping towards Lake Erie. The upper surface of the Chagrin Shale beneath the power block was characterized as a weathered horizon, consisting of highly fractured rock with lower till filling in fracture zones. The weathered surface of the Chagrin Shale was removed beneath the power block during plant construction and geologic mapping of the exposed bedrock surface determined conjugate jointing in bedrock with orientations to the northeast (N40°E) and northwest (N55°W). Shale beds within the bedrock naturally dip to the south, with the angle of dip less than one degree. There are some fractures within the Chagrin Shale.

Subsurface water accumulating above the till and within the glacial lacustrine deposit results in a semi-perched groundwater condition and represents the main water-bearing zone at PNPP. Permeable materials within the fine-grained lacustrine deposits are composed generally of thin layers (a few inches thick) of silty sand. Water levels in observation wells in the lacustrine deposits rise rapidly during and immediately after periods of precipitation, then drop during dry periods. Little water is found in the glacial till overlying the shale. Locally, the shale bedrock receives only very small amounts of recharge because the till serves as a barrier to downward movement of water. The pre-construction piezometric groundwater surface was approximately three to five feet below the ground surface at the plant location.

The contribution of groundwater from each geologic unit to the underdrain system is controlled by the relative hydraulic conductivity of each unit. The glacial lacustrine, upper, and lower till, and Chagrin Shale all have relatively low hydraulic conductivity values. The glacial lacustrine deposit exhibits the highest relative hydraulic conductivity; therefore, the majority of groundwater entering the underdrain system originates from this unit. The power block excavations removed the upper and lower till, effectively resulting in the hydraulic connection of the glacial lacustrine deposit and the Chagrin Shale at the power block.

The groundwater removal rate within the underdrain system is approximately 30 gpm, or 45,000 gallons per day (gpd). Dividing this value by the estimated saturated surface area of the construction excavation can be used to approximate aquifer transmissivity. This indicates that the combined aquifers contribute between 0.1 and 0.5 gallons per square foot. This is consistent with equivalent literature hydraulic conductivity values for till of 10^{-6} to 10^{-7} cm/sec, indicating the average permeability of water-bearing units interfacing with the underdrain system is very low.

Based on preconstruction data, the elevation of groundwater within the upper till is lower than the elevation of groundwater in the lower till. The elevation of groundwater is estimated to be lower in both till units than measured with the glacial lacustrine deposit. These observations, combined with the relative permeability information, indicate that shallow groundwater with the lacustrine unit may be perched over the upper till unit. Preconstruction groundwater levels in the Chagrin Shale are lower than the glacial lacustrine, upper, and lower till deposits. This suggests that the overall direction of vertical flow beneath the site may be downward due to a predominantly downward vertical gradient. Alternatively, this may suggest that the Chagrin Shale is semi-confined by the upper, and lower till, except where the till units were excavated at the power block, where the hydraulic connection would be greatest.

Preconstruction data indicates that groundwater flow in the Chagrin Shale is towards Lake Erie. Groundwater flow within the Chagrin Shale occurs within bedding planes, joints, fractures, and lineaments. In order to understand the direction of groundwater flow in the Chagrin Shale, it is critical to understand the orientation of these structural features. The predominant orientations of bedrock fractures prevalently trend to the northeast and northwest. The dip of the beds within the Chagrin Shale is less than one percent to the south. A lineament analysis conducted in 2006 showed that the majority of surface lineaments are orientated southeast-northwest. This orientation is consistent with one of the joint orientations mapped during the preconstruction excavation.

Groundwater recharge in the plant area is mostly from precipitation rather than inflow from adjacent land. Field permeability tests were performed in the lacustrine materials, the principal water-bearing zone. The average measured horizontal permeabilities ranged from 1.2×10^{-4} to 4.2×10^{-7} cm/sec with an estimated mean value of approximately 1.0×10^{-5} cm/sec. The vertical permeability is estimated to range from one fifth to one fiftieth of the horizontal permeability. (EH 2021a)

3.6.2.3 Potentiometric Surfaces

The principal direction of groundwater movement is from PNPP toward Lake Erie. A regional groundwater table occurs at the site. Preconstruction groundwater levels ranged from 613 to 624 feet in elevation. Very dense, relatively impervious glacial till at a depth of about 25 to 30 feet acts as a retarding barrier to downward infiltration of precipitation. Water collecting above the till in the surficial silty and clayey fine sand, clayey silt, and silty clay lacustrine materials results in a semi-perched groundwater condition, constituting the main water-bearing zone. Permeable materials within the fine-grained lacustrine deposits generally comprise thin layers (a few inches thick) of silty sand. Water levels in observation wells in the lacustrine deposits rise rapidly during and immediately after periods of precipitation, then drop during dry periods. The preconstruction piezometric groundwater surface was approximately three to five feet below ground surface. (EH 2021a)

Regional groundwater flow beneath PNPP is generally from southeast to northwest towards Lake Erie, mimicking the topographic slope. The pre-construction gradient was approximately 26 feet per mile and the estimated pre-construction travel time from the radwaste building to Lake Erie was 25 years. Depth to groundwater in the glacial lacustrine deposit ranges from approximately four to 16 feet below ground surface. The current depth to groundwater within the glacial lacustrine deposit around the power block is highly influenced by the underdrain system.

The underdrain system is the most significant factor affecting groundwater flow at PNPP. The underdrain system creates a cone of depression within the Glacial Lacustrine deposits around the power block. The underdrain system consists of a porous concrete blanket underlying the power block structures. A 1-foot diameter porous concrete pipe carries collected water to the east and west sides of the power block. (EH 2021a) There are two discharge subsystems designed to operate independently of each other: the pumped discharge system and the gravity discharge system. In the pumped discharge system, groundwater flows by gravity into collection manholes. The system is designed to handle an inflow of 80 gpm. The water is discharged from the manholes by service underdrain pumps. If the service underdrain pumps fail, two backup pumps operate. The gravity discharge system provides an alternate flow path for drainage and provides a redundant periphery discharge path. If there is a complete failure of all pumps in the pumped discharge system, the groundwater level will rise until it reaches the level of the gravity discharge system, which incorporates a gravity outfall to handle a total flow of 30,000 gpm. A map of the underdrain system is included as Figure 3.6-6.

A groundwater divide in the Glacial Lacustrine deposits separates the groundwater influenced from the underdrain system from the groundwater that is not influenced by the underdrain system. The influence of the underdrain system on the Upper and Lower Till has not been quantified but is likely present. The underdrain system is expected to have some influence on groundwater flow in the Chagrin Shale limited to the area containing the underdrain system. The radius of influence of groundwater drawdown has been observed to be less than 500 feet, a distance within PNPP boundaries. (EH 2021a).

As mentioned earlier in Section 3.6.2.1, groundwater recharge in the plant area is mostly from precipitation rather than inflow from adjacent land. Groundwater migrates toward the natural drainage channels during the wetter periods when the aquifer becomes filled to capacity. Groundwater seepage from the lacustrine deposits occurs also along the face of the Lake Erie shoreline bluff. (EH 2021a)

A groundwater contour (potentiometric surface) map of the Glacial Lacustrine and till deposits is provided as Figure 3.6-7. The groundwater potentiometric surface map is based on groundwater level data collected in April 2020 as part of the Nuclear Energy Institute (NEI) groundwater protection initiative (GPI) program, which is discussed in the following Section

3.6.2.4. Groundwater observation wells installed at PNPP in 1975 have shown a maximum seasonal variation of 6.4 feet, peak to trough (EH 2021a).

3.6.2.4 Groundwater Protection Program

In May 2006, the NEI implemented the GPI, an industry-wide voluntary effort to enhance nuclear power plant operators' management of groundwater protection (NEI 2007).

Industry implementation of the GPI identifies actions to improve licensee management and response to instances where the inadvertent release of radioactive substances may result in detectable levels of plant-related materials in subsurface soils and water, and also describes communication of those instances to external stakeholders. Aspects addressed by the GPI include site hydrology and geology, site risk assessment, onsite groundwater monitoring, and remediation. In August 2007, NEI published updated guidance on implementing the GPI as NEI 07-07, Industry Ground Water Protection Initiative-Final Guidance Document (NEI 2007). This guidance was further updated in February 2019. The purpose of NEI 07-07 is to improve the management of situations involving inadvertent radiological releases that get into groundwater and to improve communications with external stakeholders to enhance trust and confidence on the part of local communities, states, the NRC, and the public in the nuclear industry's commitment to a high standard of public radiation safety and protection of the environment. (NEI 2019)

This initiative was developed to ensure timely and effective management of situations involving inadvertent releases of licensed material to groundwater (NEI 2019). PNPP implemented a Groundwater Protection Program (GPP) in 2006. This program initially began with a baseline evaluation of the site hydrogeologic characteristics and assessment of potential plant operations that could impact site groundwater quality.

Twenty-one indoor piezometers were installed in 1975 during plant construction. They are located within the lower level of the power block buildings. The piezometers are solid pipes with open ends located beneath the foundation slabs to monitor groundwater levels and hydrostatic pressures within the porous concrete layer of the underdrain system. More than 30 outdoor piezometers were installed to monitor the underdrain system performance in 1975, 1983/84, or 1989. The outdoor piezometers are screened below the surface of the natural water table. The outdoor piezometers are located in four separate transects oriented in the north, south, east, and west directions.

The historical piezometers were insufficient by themselves to create an effective groundwater monitoring program at PNPP because they do not provide adequate lateral and vertical monitoring coverage. Following the initial desktop study, 12 new triplet groundwater monitoring wells were installed in four locations at PNPP for the GPI to assess data gaps and to increase the reliability of the historical piezometer network, and groundwater sampling activities commenced in 2007. Since most of the groundwater flows north toward Lake Erie, three monitoring well triplets were installed downgradient to the north of PNPP. A triplet of monitoring wells was drilled upgradient and south of the plant (MW-1A, MW-1B, and MW-1C) to assess a typical groundwater profile. Each set of well triplets has a shallow well with a depth of approximately 25 feet, a mid-depth well with a depth of approximately 50 feet, and a deep well of approximately 75 feet in depth. These three depths are designated A, B, and C, from shallowest to deepest, respectively. (EH 2021b) Monitoring wells MW-1C, MW-2C, MW-3C, and MW-4C were advanced into the Chagrin Shale. Visible fractures were noted in MW-4C.

Since installation of the site-specific groundwater protection program (GPP), PNPP has been conducting routine groundwater monitoring and reporting. In 2015, the first periodic review of the GPP was completed.

Required sampling is described in the chemistry specifications plant procedure. The 12 groundwater monitoring wells and quadrant piezometers (N-3-83, E-2-83, S-2-89, and W-7-83) are sampled twice a year, in the spring and fall and analyzed for gamma isotopes and tritium. Any positive result less than 500 picoCuries per liter (pCi/L) is considered as background activity and not due to plant operations. The ODCM reporting level for tritium in an environmental water sample is 20,000 pCi/L (EPA drinking water limit). In 2021, tritium was not detected above background in any of the sampled wells or piezometers. (EH 2022c)

PNPP also samples underdrain manholes to monitor effluent concentrations before underdrain system water is discharged to Lake Erie. Underdrain manholes MH-20 to the west and MH-23 to the east are sampled quarterly for principal gamma emitters and tritium by PNPP personnel in accordance with site procedures. (EH 2021b) As described in Section 3.6.4.2, tritium was detected above background level (but below the EPA drinking water limit of 20,000 pCi/L) in the underdrain manholes.

No gamma or difficult-to-detect radionuclides, other than naturally occurring radionuclides, were identified in well samples between 2017 and 2021.

In conjunction with the GPI, Energy Harbor performs groundwater monitoring from a network of groundwater monitoring wells, indoor and outdoor piezometers, and manholes to monitor for potential radioactive releases to groundwater, environmental conditions, and groundwater elevation in accordance with site procedures. Figure 3.6-7 shows locations of the groundwater monitoring wells with construction details presented in Table 3.6-3.

3.6.2.5 Sole Source Aquifers

A sole source aquifer (SSA), as defined by the EPA, is an aquifer that supplies at least 50 percent of the drinking water consumed by the area overlying the aquifer, and there is no reasonably available alternative drinking water source should the aquifer become contaminated. The SSA program was created by the U.S. Congress as part of the Safe Drinking Water Act and allows for the protection of these resources. (EPA 2022c) All proposed projects receiving federal funds are subject to review to ensure they do not endanger the water source.

PNPP is in EPA Region 5, which has oversight responsibilities for the public water supply in Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin, and 35 Tribal Nations. Four federally designated SSAs are in Ohio: Bass Islands Aquifer under Catawba Island (Ottawa County), the Pleasant City Aquifer (Guernsey County), the northern and southern Great Miami/Little Miami River Basins Buried Valley Aquifer system (southwestern Ohio), and the Allen County Area Combined Aquifer System (western Ohio) (OEPA 2009). The SSA located nearest PNPP, the Bass Islands Aquifer, is located approximately 89 miles from PNPP. Therefore, PNPP is not situated over any of these designated SSAs. (EPA 2022c)

3.6.3 Water Use

3.6.3.1 Surface Water Use

The primary source of potable water for most municipalities in the site area is Lake Erie. Nearby communities of Perry, Madison-on-the-Lake, Madison, and North Madison are serviced from underground distribution lines. In large part, the Lake County Department of Utilities obtains its water supply from Lake Erie. Intermixed to a degree are domestic users with private wells. A distribution line runs along Center Rd to supply PNPP and residents bordering on Center Rd with potable water. Domestic water users beyond the distribution system rely upon groundwater supplied from wells. (EH 2021a)

The ultimate heat sink for PNPP is Lake Erie (EH 2021a). As presented in Section 2.2.3.1, PNPP uses a closed-cycle circulating water system. Water is taken from Lake Erie by means of intake structures located approximately 2,600 feet offshore and 13.3 feet below the surface of the lake based on low water datum level at elevation 570.5 feet. A 10-foot inner diameter intake tunnel conveys the water to two onshore pumphouse structures, the service water pumphouse, and the ESW pumphouse. Both systems are once-through, as described in the following paragraphs. Water is returned to the lake through the discharge tunnel. A 10-foot diameter cross tie tunnel between the discharge tunnel and the ESW pumphouse is provided as a redundant water supply for the ESW pumps. Either tunnel can supply sufficient water to permit the safe shutdown and cooldown of the reactor unit. (EH 2021a)

The service water system consists of an open loop piping network in which lake water from the cooling water intake structure is pumped through the heat exchangers being cooled and directed as necessary to the cooling tower basin as makeup. That amount of water not required for makeup is returned to the lake by way of the discharge tunnel water return line. (EH 2021a)

Makeup for tower evaporation, wind loss, and blowdown is obtained from the service water system. This water comes from Lake Erie via the intake tunnel into a service water pumphouse. Service water pumps transmit the water to the plant through various heat exchangers in the service water system. It then goes to a weir box from which flow is diverted to the cooling tower basin, with the remainder going directly to the lake by means of the discharge tunnel entrance structure. Makeup flow to the cooling tower varies from 16,000 gpm to 25,979 gpm, depending on atmospheric conditions. (EH 2021a)

The blowdown is added to the service water discharge flow and is conveyed to the discharge tunnel entrance structure from which it will flow to the lake by means of the discharge tunnel.

Blowdown from the cooling tower varies from 6,000 gpm to 10,332 gpm, depending on atmospheric conditions. (EH 2021a)

Potable and sanitary water is obtained from the Lake County Department of Utilities water main, which is extended onto PNPP. No interconnections exist between the potable and sanitary water system and any process system containing radioactive or potentially radioactive liquid. Backflow preventers are located in the system's connection with the offsite water source. The backflow preventors inhibit flow from the site to the offsite water supply. If the potable water system became potentially contaminated, the backflow preventers would ensure that the offsite supply would not be affected. (EH 2021a)

There are no users of water from the minor or major streams. The Neff Perkins Corporation formerly withdrew water from a pond near the downstream end of the major stream, but it is no longer in operation. (EH 2021a)

Table 3.6-1 presents monthly water levels for Lake Erie in 2021 along with long term mean, maximum, and minimum water levels for 1935 through 2021.

PNPP is registered with the Ohio Department of Natural Resources (ODNR) as a Water Withdrawal facility for surface water withdrawal from Lake Erie but a permit for the withdrawal is not required. The average surface water withdrawal rate for PNPP in 2021 was reported as 2,641.98 million gallons per month (MGM) and averaged 2,755.86 MGM between 2017 and 2021 (Table 3.6-4a). A summary of monthly surface water withdrawals reported by PNPP between 2017 and 2021 is included as Table 3.6-4b.

In 2015, total surface water withdrawals in Lake County were reported as 184.24 million gallons per day (MGD), of which 151.39 MGD was used for power generation. Excluding power generation, surface water use for Lake County was reported as 32.85 MGD. The total surface water withdrawals in Ashtabula County to the east were reported as 213.42 MGD, of which 180.82 MGD was withdrawn for power generation. The total surface water withdrawals for Geauga County to the south were reported as 0.65 MGD, which was withdrawn for domestic and agricultural use, with no surface water withdrawals for power generation. (USGS 2022b) A summary of surface water use in Lake, Ashtabula, and Geauga Counties is presented in Table 3.6-5.

3.6.3.2 Groundwater Use

Lake Erie is located adjacent to the northern side of the plant and is the primary discharge point for groundwater, stormwater, and surface water that originate from PNPP. Historically, groundwater was the primary source of drinking water in the vicinity of the PNPP; however, several areas were serviced with municipal water lines during plant construction. There were hundreds of residential water supply wells located in North Perry and Perry prior to the construction of PNPP. Most of the wells were screened in the glacial lacustrine deposit. All of the wells located on the PNPP property have been abandoned. At the time that the License

Stage Environmental Report was prepared (1981), the closest Lake Erie intake to PNPP was at Fairport Harbor, approximately 7 miles west of the site.

Current drinking water source protection areas for groundwater and surface water from the OEPA Division of Drinking and Ground Waters in the vicinity of PNPP indicate that Lake Erie is the source of most of the drinking water supplies within 5 miles of PNPP. All of the areas are located upgradient or cross-gradient from PNPP. Therefore, releases to groundwater at PNPP are expected to maintain a low potential to impact nearby drinking water wells, if still in use. Lake Erie is also actively used for swimming, fishing, and other recreational activities. Any tritium making it to Lake Erie would immediately be diluted to background levels due to the volume of water in the lake.

Near PNPP, many residential users obtain their water supplies from shallow wells. Most of the well supplies are used for drinking and other domestic purposes. Both drilled and hand-dug wells obtain water from the lacustrine deposits with yields usually less than 5 gpm. Deeper wells completed in shale yield relatively minor quantities of water. Near Lake Erie, wells penetrating shale commonly encounter salty water, sulfurous water, or even gas at shallow depths. (EH 2021a) Owing to the generally low yield of usually less than 5 gpm in wells within lacustrine deposits (the water-bearing zone) in Perry and Madison TWPs, the number of future groundwater users is not expected to increase greatly. The low permeability ($<10^{-4}$ cm/sec) and the limited storage capacity of the aquifer is expected to minimize the amount of groundwater available for the development of new well supplies. The effects on groundwater flow direction, gradients, rates, and water levels because of future groundwater withdrawals are not expected to be significantly altered or to cause groundwater flow reversal in the area outside the PNPP boundary. (EH 2021a)

There are no water supply wells at PNPP. Water well supplies in the area are inadequate for plant needs. All water for plant use is obtained from Lake Erie, except potable water and backup fire service water, which is supplied by the Lake County Department of Utilities (EH 2021a;).

As mentioned in Section 3.6.2.3, a pressure relief underdrain system is located beneath the primary plant structures to reduce the hydrostatic pressures and to increase the dynamic stability of the structures (EH 2021a). A porous concrete pipe between some of the buildings and around the perimeter of the nuclear island carries the collected water to individual pumps located in manholes on the east and west sides of the nuclear island. The design groundwater inflow of up to 80 gpm flows by gravity through the porous concrete blanket and pipes to collection manholes containing the three service underdrain pumps. These pumps are set to maintain a water surface elevation of 568 feet or below. (EH 2021a)

PNPP measures inflow to the underdrain system semiannually by placing inflow sensors in some of the manholes. During the October 2021 Plant Underdrain Groundwater Inflow Test and Continuity Test, inflow rate was measured at 31.35 gpm, below the design limit of 80 gpm.

The network of pumping and gravity drainage manholes are connected to the porous concrete perimeter pipe to transfer water from the underdrain system to the ESW pump house suction bay, where the water is either reused as part of the ESW or discharged to Lake Erie. The underdrain system also serves to contain and capture potential leakage of tritiated water from within the power block.

An accidental release of radioactive contamination into the ground at PNPP is highly unlikely. Postulating an accidental release of radioactive materials occurring at the radwaste building of PNPP, the pumps installed in the pumping manholes of the pressure relief underdrain system will be manually shut off, allowing groundwater to build up to elevation 590 feet within the underdrain system and discharge via the gravity drains to the ESW pumphouse, and eventually into Lake Erie. In addition, radiation monitors located in the gravity discharge manholes will automatically stop the service and backup underdrain pumps upon detection of high radioactivity. (EH 2021a)

Further, assuming an accidental release of radioactive materials was to occur at the radwaste building and was to assume a travel path through the soils, the estimated transit time to the point of discharge into Lake Erie is 25 years if the groundwater was allowed to return to elevation 620 feet. The maximum groundwater velocity would likely occur within the lacustrine deposits (upper 25 feet) as the underlying tills are relatively impervious. Coefficient of permeability K calculated from field testing within lacustrine materials ranged between 1.2×10^{-4} and 4.2×10^{-7} cm/sec. (EH 2021a)

There are currently no discharges to groundwater from PNPP requiring permits by regulatory agencies.

In 2015, groundwater withdrawals in Lake County were reported as 1.1 MGD with no withdrawal for power generation. Domestic supply and irrigation withdrawals are reported as the largest consumers of groundwater, reported at 0.86 and 0.23 MGD, respectively, in Lake County. Domestic supply is the largest consumer of groundwater in Ashtabula and Geauga Counties, reported at 1.18 and 5.29 MGD, respectively. (USGS 2022b) A summary of groundwater use in Lake, Ashtabula, and Geauga Counties is presented in Table 3.6-6.

A list of 71 offsite registered groundwater wells within 2 miles of the PNPP center point (Figure 3.6-9) is presented in Table 3.6-7. The majority of these wells withdraw groundwater from sand in the surficial aquifer and are primarily used for domestic purposes.

3.6.4 Water Quality

3.6.4.1 Surface Water Quality

Section 305(b) of the Clean Water Act (CWA) requires each state to report every two years to the EPA on the condition of its surface waters, and Section 303(d) requires each state to report on its impaired water bodies (those not meeting water quality standards). A review of the

OEPA's 2020 303(d) list of impaired waters included the following impaired waters within a 6-mile radius (OEPA 2022b; OEPA 2022c).

- McKinley Creek-Frontal Lake Erie, Assessment Unit ID (AUID) 04110003 02 04, recreational use *Escherichia coli*. In the draft 2022 report, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls (PCBs) are delisted (OEPA 2022b).
- Lake Erie Central Basin Shoreline, Assessment Unit ID 04120200 02 03, PCBs (OEPA 2022b)
- Grand River Mainstream, Assessment Unit ID 04110004 90 01, recreational use *E. coli*, fish tissue assessment PCBs.

The known permitted discharges to Lake Erie are limited to those from the existing unit. These sources and permitted discharge limits are described in the NPDES permit. PNPP is in compliance with its NPDES permit, discussed in Section 3.6.1.2.1, and does not contribute to these impairments.

3.6.4.2 Groundwater Quality

The groundwater sampling programs at PNPP include a combination of GPI groundwater monitoring wells, piezometers, and manholes to monitor performance of the underdrain system. Onsite groundwater is monitored at PNPP in accordance with the guidance presented in NEI 07-07, discussed in Section 3.6.2.4. PNPP monitors groundwater for tritium as part of the GPP. The groundwater monitoring wells and piezometers are sampled at different frequencies.

- Two of the twelve groundwater monitoring wells (MW-2C and MW-3C) are sampled on a biennial basis. The remaining 10 groundwater monitoring wells are sampled semiannually.
- The indoor piezometers are gauged weekly. Five indoor piezometers (P-2, P-6, P-7, P-9, and P-11) are sampled semiannually for tritium and gamma emitters. Other indoor piezometers are sampled as needed to support plume characterization assessment if/when radioactive contamination is identified.
- Outdoor piezometers are gauged quarterly. Four outdoor piezometers, one from each transect (typically E-1-83, N-3-84, S-1A-84, and W-7-83), are sampled semiannually for tritium and gamma emitters as part of the GPI sampling program.
- Underdrain manholes MH-20 and MH-23 are sampled quarterly for tritium and gamma emitters and biennially for other parameters. Additional manholes may be sampled as needed. Manholes MH-20 and MH-23 are sampled periodically to monitor effluent concentrations before underdrain system water is discharged to Lake Erie. These two manholes represent a composite of all groundwater within the porous concrete layer and groundwater captured in the glacial lacustrine deposit and pumped sequentially through the underdrain system.

Groundwater sampling for GPI and outdoor piezometers has occurred regularly since the program began in 2007. Energy Harbor has committed to voluntary notifications to the State of Ohio for positive groundwater tritium levels greater than or equal to 2,000 pCi/L.

As stated above, the monitoring wells and quadrant outdoor piezometers are sampled twice annually (spring and fall) and analyzed for gamma isotopes and tritium. Tritium was not detected in these monitoring wells and piezometers above the EPA maximum containment level (MCL) of 20,000 pCi/L (drinking water standard) or the background concentration of 500 pCi/L for 2017 through 2021. (EH 2020; EH 2021b; EH 2022c; FENOC 2018; FENOC 2019)

The following liquid releases were reported in 2020 and 2021.

- On January 31, 2020, a leak developed from the reactor coolant system into the Nuclear Closed Cooling (NCC) system. Reactor coolant leakage was validated by the observed short half-life nuclides in the NCC system. Once the reactor coolant leak into NCC was secured, sampling continued daily. Residual tritium activity was detected in the NCC system in January, March, April, May, June, July, and December. Cobalt-60 was detected in the February batch environmental counts and March composite with the range of 1.04E-07Ci to 1.82E-06Ci. Gross alpha activity was detected in the November monthly composite. (EH 2021b)
- Samples from underdrain manholes MH-20 and MH-23 are analyzed quarterly. Between 2016 and 2020, the highest tritium detection in MH-23 was 5,310 pCi/L in March 2020. Upon discovery of the elevated tritium activity in MH-23, PNPP initiated condition reports. A monitoring and sampling plan led to the discovery of tritium being introduced into underdrain MH-9 via a drain line from the auxiliary boiler deaerator that had become contaminated with tritium by a steam leak. Tritium was observed in MH-9 in March 2020 up to 13,200 pCi/L. After this issue was addressed, tritium concentrations in both MH-9 and MH-23 returned to less than the lower limit of detection (LLD). Quarterly composite samples were collected and analyzed for tritium and gamma emitters. Gamma emitters were not detected above the ODCM-required lower limit of detection, and tritium was detected during the third and fourth quarters. (EH 2021b) The investigation of the detected activity from the auxiliary boiler deaerator continued in 2021. Tritium was detected in manhole MH-23 in March, April, June, and November 2021. Tritium released in 2021 totaled 2.52×10^{-2} Ci. (EH 2022c)
- On December 14, 2021, a release was detected by the NCC Process Radiation Monitor. A failed thermal neck on a Reactor Water Clean Up pump caused the release. The pump was repaired and returned to service. Tritium was the only isotope identified in the NCC monthly composites with 3.27×10^{-4} Ci released. Activity was assessed in the monthly effluent surveillance. (EH 2022c)
- Tritium was detected in manhole MH-20 on December 16, 2021, at 1,750 pCi/L with no detectable gamma activity. A backup sample was obtained on December 17, 2021, with 2,050 pCi/L of tritium, which exceeded the voluntary reporting requirement of 2,000 pCi/L. A voluntary report was made on December 17, 2021. An investigation, chemistry

sampling plan, and tritium action plan were implemented to identify the source. The sampling plan included sample collection from additional manholes and some of the indoor piezometers. Tritium detections were the highest in samples collected from indoor piezometer PZ-3. Tritium detections ranged from 10,100 to 14,800 pCi/L, below the MCL of 20,000 pCi/L, in piezometer PZ-3 for samples collected in December 2021 and January 2022. Three potential sources were identified during the investigation, but a single source was not determined. Tritium activity has returned to background levels since the December 2021 discovery. Tritium levels continue to be monitored and tracked with analytical results for samples collected from manhole MH-20 reported in ARERRs. (EH 2022c)

There was no indication of any effluent releases in groundwater and no known spills/leaks to groundwater 2017 through 2021. No additional gamma isotopes were identified in well samples from 2017 through 2021. (EH 2020; EH 2021b; EH 2022c; FENOC 2018; FENOC 2019)

Industrial practices at PNPP that involve the use of chemicals are those activities typically associated with painting, cleaning of parts/equipment, refueling of onsite vehicles/generators, fuel oil and gasoline storage, and the storage and use of water treatment additives. The use and storage of chemicals at PNPP are controlled in accordance with Energy Harbor procedures and a site-specific spill prevention plan. In addition, as presented in Section 2.2.7, nonradioactive waste is managed in accordance with PNPP's waste management procedure, which contains preparedness and prevention control measures.

3.6.4.2.1 History of Radioactive Releases

As presented in Section 3.6.4.2 above, liquid releases were reported in 2020 and 2021. However, tritium was not detected in groundwater samples above the reporting limit of 20,000 pCi/L or the background concentration of 500 pCi/L for 2017 through 2021.

Based on this information and the guidance in NEI 07-07, there is no requirement for notification to the NRC or local officials and no requirement for remediation as it is not considered licensed material. Continued monitoring will occur as part of the groundwater monitoring program and any new sources of tritium or increase in the activity will be evaluated and remediated, as necessary. (EH 2022c)

3.6.4.2.2 History of Nonradioactive Releases

Based on the review of site records from the five years from 2017 through 2021, there has been no inadvertent nonradioactive release that would be classified as an incidental spill. (EH 2020; EH 2021b; EH 2022c; FENOC 2018; FENOC 2019)

Table 3.6-1 Lake Erie Water Levels (1935-2021)

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
2021	573.10	572.74	572.76	572.93	573.10	573.18	573.53	573.47	573.03	573.07	572.91	572.68	573.04
MEAN	571.05	571.10	571.42	571.90	572.14	572.26	572.21	571.99	571.68	571.34	571.09	571.06	571.60
MAX	575.20	575.30	574.61	575.26	575.23	575.18	575.34	574.99	574.36	574.68	574.58	574.46	--
	1987	1987	2020	1982	2019	2020	2020	2019	2019	1986	1986	1986	--
MIN	566.66	566.31	567.20	567.76	568.68	568.77	568.96	568.67	567.54	567.52	567.41	567.66	--
	1935	1936	1935	1935	1935	1935	1935	1935	1941	1935	1936	1935	--

(NOAA 2022b)
Water level elevations are based on the International Great Lakes Datum of 1985.

Table 3.6-2 NPDES Water Quality Monitoring Program (Sheet 1 of 2)

Outfall	Description	Parameter	Permit Requirement	Frequency
004	Final Effluent Discharge (Loading limits based on a flow rate of 88.23 MGD.)	Temperature	No limit, °F	Daily continuous
		pH	6.5-9.0 SU	Twice weekly grab
		Total residual oxidants	0.05 mg/L maximum	Grab when discharged
		Flow rate	No limit, MGD	Continuous, daily
		Total residual chlorine	0.2 mg/L maximum	Grab when discharged
		Total low-level mercury	1,700 ng/L maximum 7.0 ng/L monthly maximum 0.57 kg/day daily load 0.0023 kg/day monthly load	Quarterly grab
		Chlorination/bromination duration	120 minutes maximum	Total when discharged
094	Final Effluent Discharge (same location as Outfall 004) for Chlorination/Bromination. (Loading limits based on a flow of 88.23 MGD.)	Temperature	No limit, °F	Daily continuous
		pH	6.5-9.0 SU	Twice weekly grab
		Total residual oxidants	0.01 mg/L maximum	Grab when discharged
		Flow rate	No limit, MGD	Continuous, daily
		Total residual chlorine	0.038 mg/L maximum	Grab when discharged

Table 3.6-2 NPDES Water Quality Monitoring Program (Sheet 2 of 2)

Outfall	Description	Parameter	Permit Requirement	Frequency
		Total low-level mercury	1,700 ng/L maximum 7.0 ng/L monthly 0.57 kg/day daily load 0.0023kg/day monthly load	Quarterly grab
		Chlorination/bromination duration	Total	When discharged
601	Internal Effluent Discharge (from the regenerant neutralization pits prior to entering Outfall 004)	pH	No limit, SU	Grab every other week
		Total Suspended Solids	100 mg/L maximum 30 mg/L monthly	Grab every other week
		Total oil and grease	20 mg/L maximum 15 mg/L monthly	Grab every other week
		Flow rate	No limit, MGD	Continuous, 24-hour total
603	Internal Effluent Discharge (from the reverse osmosis system prior to entering Outfall 004)	pH	No limit, SU	Grab every other week
		Total suspended Solids	100 mg/L maximum 30 mg/L monthly limit	Grab every other week
		Total oil and grease	20 mg/L maximum 15 mg/L monthly limit	Grab every other week
		Flow rate	No limit, MGD	Daily 24-hour total
		Total filterable residue	No limit, mg/L	Quarterly grab

Table 3.6-3 PNPP Groundwater Monitor Well Details (Sheet 1 of 3)

Well	Well Diameter[a]	Elevations (feet msl)					
		Top of Casing[b]	Top of Filter[b]	Top of Screen[b]	Bottom of Screen[b]	Bottom of Filter[b]	Well Construction Material
MW-1A	2	632.02	NM	NM	NM	NM	PVC
MW-1B	2	632.02	NM	NM	NM	NM	PVC
MW-1C	2	632.02	NM	NM	NM	NM	PVC
MW-2A	2	618.68	NM	NM	NM	NM	PVC
MW-2B	2	618.68	NM	NM	NM	NM	PVC
MW-2C	2	618.68	NM	NM	NM	NM	PVC
MW-3A	2	622.18	NM	NM	NM	NM	PVC
MW-3B	2	622.18	NM	NM	NM	NM	PVC
MW-3C	2	622.18	NM	NM	NM	NM	PVC
MW-4A	2	626.08	NM	NM	NM	NM	PVC
MW-4B	2	626.08	NM	NM	NM	NM	PVC
MW-4C	2	626.08	NM	NM	NM	NM	PVC
E-1-83	4	623.26	-	600.36	590.36	-	-
E-1A-84	4	623.21	-	567.71	557.71	-	-
E-2-83	4	622.73	-	605.52	595.52	-	-
E-3-83	4	623.90	-	595.45	585.45	-	-
E-4-83	4	623.70	-	590.52	580.52	-	-
E-5-83	4	623.06	-	592.46	582.46	-	-
E-6-83	4	622.14	-	590.53	580.53	-	-
E-7-83	4	621.61	-	609.76	599.76	-	-
E-8-83	4	621.35	-	594.67	584.67	-	-
N-1-83	4	623.51	-	598.01	588.01	-	-
N-1A-84	4	622.43	-	585.53	575.53	-	-

Table 3.6-3 PNPP Groundwater Monitor Well Details (Sheet 2 of 3)

Well	Well Diameter[a]	Elevations (feet msl)					
		Top of Casing[b]	Top of Filter[b]	Top of Screen[b]	Bottom of Screen[b]	Bottom of Filter[b]	Well Construction Material
N-2-83	4	623.87	-	599.70	589.70	-	-
N-3-83	4	623.33	-	599.15	589.15	-	-
N-4-83	4	622.40	-	599.80	589.80	-	-
N-5-83	4	621.73	-	600.17	590.17	-	-
N-6-83 (damaged)	4	623.66	-	610..26	600.26	-	-
S-1-83	4	623.94	-	600.82	590.82	-	-
S-1A-84	4	623.34	-	577.76	567.76	-	-
S-2-89	4	623.90	-	593.02	583.02	-	-
S-4-83	4	624.28	-	600.00	590.00	-	-
S-5 (damaged)	1	622.20	-	600.49	590.49	-	-
S-5-83	4	624.89	-	597.09	587.09	-	-
S-6-83	4	624.17	-	600.67	590.67	-	-
S-7 (damaged)	1	625.89	-	598.34	588.34	-	-
S-7A	4	627.60	-	606.70	596.70	-	-
S-7A-83	4	625.34	-	609.97	599.97	-	-
S-8-83	4	630.33	-	597.44	587.44	-	-
W-5-83	-	619.55	-	NM	NM	-	-
W-7 (damaged)	1	623.17	-	599.05	589.05	-	-
W-7-83	4	621.97	-	594.02	584.02	-	-
W-8 (damaged)	1	625.26	-	594.02	584.02	-	-
W-8-83	4	623.03	-	594.02	584.02	-	-
P-1	4	575.83	-	-	-	-	-
P-2	4	575.92	-	-	-	-	-

Table 3.6-3 PNPP Groundwater Monitor Well Details (Sheet 3 of 3)

Well	Well Diameter[a]	Elevations (feet msl)					
		Top of Casing[b]	Top of Filter[b]	Top of Screen[b]	Bottom of Screen[b]	Bottom of Filter[b]	Well Construction Material
P-3	4	575.92	-	-	-	-	-
P-4	4	575.83	-	-	-	-	-
P-5	4	575.92	-	-	-	-	-
P-6	4	575.83	-	-	-	-	-
P-7	4	575.92	-	-	-	-	-
P-8	4	575.92	-	-	-	-	-
P-9	4	575.92	-	-	-	-	-
P-10	4	576.19	-	-	-	-	-
P-11	4	575.83	-	-	-	-	-
P-12	4	575.83	-	-	-	-	-
P-13	4	575.83	-	-	-	-	-
P-14	4	572.00	-	-	-	-	-
P-15	4	571.95	-	-	-	-	-
P-16	4	572.00	-	-	-	-	-
P-17	4	572.02	-	-	-	-	-
P-18	4	572.00	-	-	-	-	-
P-19	4	572.00	-	-	-	-	-
P-20	4	572.13	-	-	-	-	-
P-21	4	572.00	-	-	-	-	-

Note: Dashed cells indicate data was not reported.

a. Measured in inches.
b. Approximate measurement.

NM = Not Measured (due to location below sidewalk)
PVC = polyvinyl chloride

Table 3.6-4a PNPP Yearly Surface Water Withdrawal Summary

Year		2017	2018	2019	2020	2021	2017-2021
Monthly Maximum	MGM	3,649	3,522	3,656	3,411	3,234.94	3,656
	gpm$_a$	81,742.83	78,897.85	81,899.64	76,411.29	72,467.29	81,899.64
Monthly Average	MGM	2,752.25	2,773.25	2,862	2,749.83	2,641.98	2,755.86
	gpm$_a$	62,723.27	63,235.75	65,270.15	62,611.34	60,296	62,827.3
Monthly Minimum	MGM	1,875	2,118	2,326	2,326	2,207.96	1,875
	gpm$_a$	43,402.78	52,529.76	57,688.49	53,842.59	54,760.91	43,402.78
Yearly Total	MGY	33,025.38	33,279	34,344	32,999	31,703.83	33,070.24
	MGD	90.48	91.18	94.09	90.16	86.86	90.55

MGY - millions of gallons per year
MGD - millions of gallons per day
MGM - millions of gallons per month
gpm$_a$ - gallons per minute for the month

Table 3.6-4b PNPP Monthly Surface Water Withdrawal Summary (Page 1 of 3)

Month	Intake (MGM)	Total (gpm[a])
January-2017	2,176	48,745.52
February-2017	1,974	48,958.33
March-2017	2,265	50,739.25
April-2017	1,875	43,402.78
May-2017	2,600	58,243.73
June-2017	3,112	72,037.04
July-2017	3,649	81,742.83
August-2017	3,559	79,726.70
September-2017	3,391	78,495.37
October-2017	3,431	76,859.32
November-2017	2,455	56,828.70
December-2017	2,540	56,899.64
January-2018	2,579	57,773.30
February-2018	2,118	52,529.76
March-2018	2,346	52,553.76
April-2018	2,512	58,148.15
May-2018	2,633	58,982.97
June-2018	2,760	63,888.89
July-2018	3,502	78,449.82
August-2018	3,522	78,897.85
September-2018	3,290	76,157.41

Table 3.6-4b PNPP Monthly Surface Water Withdrawal Summary (Page 2 of 3)

Month	Intake (MGM)	Total (gpma)
October-2018	2,963	66,375.45
November-2018	2,484	57,500.00
December-2018	2,570	57,571.68
January-2019	2,590	58,019.71
February-2019	2,326	57,688.49
March-2019	2,659	59,565.41
April-2019	2,499	57,847.22
May-2019	2,482	55,600.36
June-2019	2,690	62,268.52
July-2019	3,609	80,846.77
August-2019	3,656	81,899.64
September-2019	3,443	79,699.07
October-2019	3,336	74,731.18
November-2019	2,489	57,615.74
December-2019	2,565	57,459.68
January-2020	2,650	59,363.80
February-2020	2,441	58,453.07
March-2020	2,396	53,673.84
April-2020	2,587	59,884.26
May-2020	2,493	55,846.77
June-2020	3,047	70,532.41

Table 3.6-4b PNPP Monthly Surface Water Withdrawal Summary (Page 3 of 3)

Month	Intake (MGM)	Total (gpm$_a$)
July-2020	3,411	76,411.29
August-2020	3,387	75,873.66
September-2020	3,239	74,976.85
October-2020	2,591	58,042.11
November-2020	2,326	53,842.59
December-2020	2,430	54,435.48
January-2021	2,480.89	55,575.49
February-2021	2,207.96	54,760.91
March-2021	2,605.41	58,364.92
April-2021	2,293.11	53,081.25
May-2021	2,327.07	52,129.70
June-2021	2,945.97	68,193.75
July-2021	3,234.94	72,467.29
August-2021	2,792.75	62,561.60
September-2021	2,930.16	67,827.78
October-2021	2,781.93	62,319.22
November-2021	2,600.9	60,206.02
December-2021	2,502.7	56,064.07

MG - millions of gallons
MGM - millions of gallons per month
gpm$_a$ - gallons per minute for the month

Table 3.6-5 Surface Water Usage Summary in MGD, 2015

Category	Lake County	Ashtabula County	Geauga County
Public Supply	22.82	6.72	0.00
Domestic, Self-Supplied	0.02	0.02	0.11
Industrial, Self-Supplied	0.09	20.55	0.00
Irrigation	9.92	0.05	0.40
Livestock	0.00	0.14	0.14
Aquaculture	0.00	5.10	0.00
Mining	0.00	0.02	0.00
Power Generation (Thermoelectric)	151.39	180.82	0.00
Total	**184.24**	**213.42**	**0.65**

(USGS 2022b)

Table 3.6-6 Groundwater Usage Summary in MGD, 2015

Category	Lake County	Ashtabula County	Geauga County
Public Supply	0.00	0.48	1.45
Domestic, Self-Supplied	0.86	1.18	5.29
Industrial, Self-Supplied	0.00	0.00	0.10
Irrigation	0.23	0.01	0.08
Livestock	0.01	0.09	0.13
Aquaculture	0.00	0.00	0.00
Mining	0.00	0.00	1.02
Power Generation (Thermoelectric)	0.00	0.00	0.00
Total	**1.10**	**1.76**	**8.07**

(USGS 2022b)

Table 3.6-7 Offsite Registered Water Wells within 2 Miles of PNPP (Sheet 1 of 3)

ODNR Well No.	Distance[(a)] (miles)	Well Depth (feet)	Use Description	Aquifer Name
223723	0.9	45	Unspecified Water Well	Sand
422633	1.2	24	Domestic	Silt & Clay
2000202	1.3	20	Domestic	Sand
933098	1.3	25	Domestic	Sand & Silt
2000201	1.3	20	Domestic	Sand
2000199	1.3	20	Unspecified Water Well	Sand
339881	1.3	41	Domestic	Sand
303452	1.3	64	Domestic	Sand
393247	1.4	105	Domestic	Shale
962097	1.4	48	Unspecified Water Well	Sand
513898	1.4	54	Domestic	Gravel & Clay
299549	1.4	40	Unspecified Water Well	Sand & Gravel
462631	1.4	30	Domestic	Sand
422625	1.4	31	Domestic	Silt/Sand/Gravel
405713	1.4	32	Agricultural/Irrigation	Gravel
299538	1.5	32	Unspecified Water Well	Sand & Gravel
339856	1.5	38	Domestic	Silt
444676	1.5	52	Domestic	Silt & Clay
666622	1.5	36	Domestic	Gravel & Clay
358559	1.5	30	Domestic	Sand & Silt
647155	1.5	34	Domestic	Sand & Gravel
289642	1.5	38	Domestic	Sand & Gravel
666635	1.5	40	Agricultural/Irrigation	Gravel & Clay
276264	1.6	18	Domestic	Sand & Clay
319347	1.6	46	Unspecified Water Well	Sand
666636	1.6	41	Domestic	Gravel & Clay
386652	1.6	46	Domestic	Silt & Clay
549894	1.6	20	Unspecified Water Well	Dug Well
219286	1.6	86	Unspecified Water Well	Sand & Gravel
405731	1.6	38	Domestic	Sand & Gravel
375390	1.7	40	Domestic	Sand & Gravel
2051771	1.7	48	Domestic	Sand & Gravel

Table 3.6-7 Offsite Registered Water Wells within 2 Miles of PNPP (Sheet 2 of 3)

ODNR Well No.	Distance[(a)] (miles)	Well Depth (feet)	Use Description	Aquifer Name
986026	1.7	30	Domestic	Unspecified
527393	1.7	44	Domestic	Sand & Gravel
375370	1.7	40	Domestic	Sand & Gravel
358595	1.7	40	Domestic	Sand & Gravel
342585	1.7	56	Commercial	Sand
203244	1.7	30	Domestic	Sand
450312	1.7	37	Domestic	Gravel & Clay
226890	1.7	34	Domestic	Sand
991895	1.7	20	Heating/Cooling	Sand
596438	1.7	30	Heating/Cooling	Sand
358572	1.8	30	Heating/Cooling	Sand
358580	1.8	35	Heating/Cooling	Sand & Gravel
549855	1.8	32	Domestic	Sand
98238	1.8	44	Heating/Cooling	Sand & Clay
339857	1.8	36	Heating/Cooling	Sand
226863	1.8	31	Domestic	Sand
528251	1.8	35	Domestic	Gravel
375373	1.8	32	Domestic	Sand
666639	1.8	33	Unspecified Water Well	Sand
289615	1.9	26	Domestic	Sand
375369	1.9	30	Unspecified Water Well	Sand & Silt
226891	1.9	25	Unspecified Water Well	Sand
2006521	1.9	110	Domestic	Shale
103332	1.9	36	Domestic	Sand
386657	1.9	30	Domestic	Sand
422640	1.9	35	Domestic	Gravel & Clay
2003468	1.9	150	Unspecified Water Well	Sand & Gravel
2003464	1.9	150	Domestic	Sand & Gravel
2003467	1.9	150	Domestic	Sand & Gravel
2003469	1.9	150	Domestic	Sand & Gravel
319314	1.9	31	Unspecified Water Well	Sand
2003466	1.9	150	Domestic	Sand & Gravel
2003412	1.9	115	Unspecified Water Well	Sand & Gravel
492443	1.9	42	Domestic	Sand

Table 3.6-7 Offsite Registered Water Wells within 2 Miles of PNPP (Sheet 3 of 3)

ODNR Well No.	Distance[(a)] (miles)	Well Depth (feet)	Use Description	Aquifer Name
181535	2.0	30	Domestic	Sand
299550	2.0	30	Agricultural/Irrigation	Sand
422606	2.0	35	Unspecified Water Well	Silt & Clay
638983	2.0	40	Domestic	Sand & Clay
666225	2.0	40	Domestic	Sand

(ODNR 2022b)

a. Distance is from the PNPP center point and rounded to the nearest tenth of a mile. Wells listed are limited to those within a 2-mile radius from the site center point.

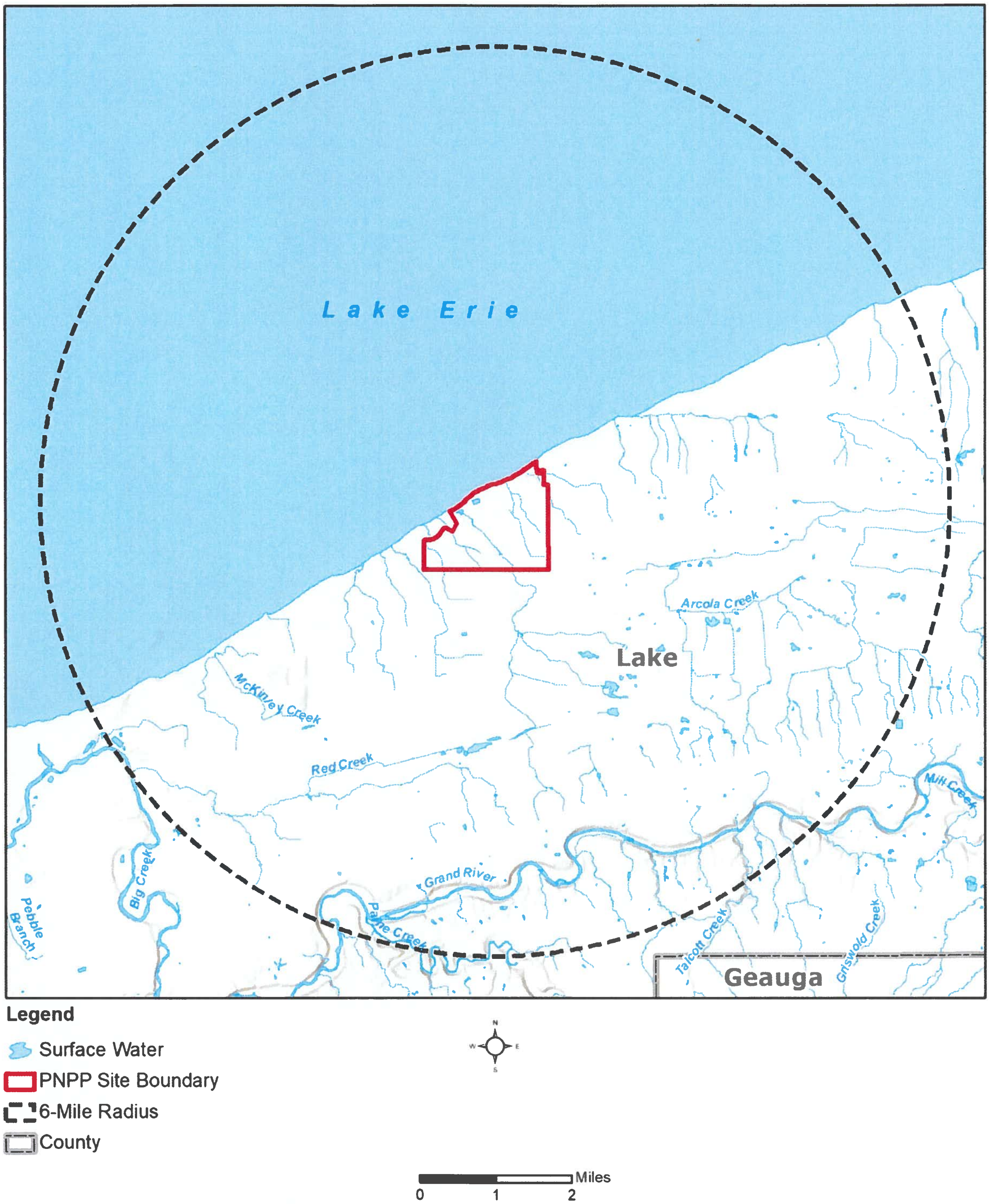


Figure 3.6-1 Vicinity Hydrological Features

Figure 3.6-2 FEMA Floodplain Zones at PNPP

Figure 3.6-3 NPDES Outfalls

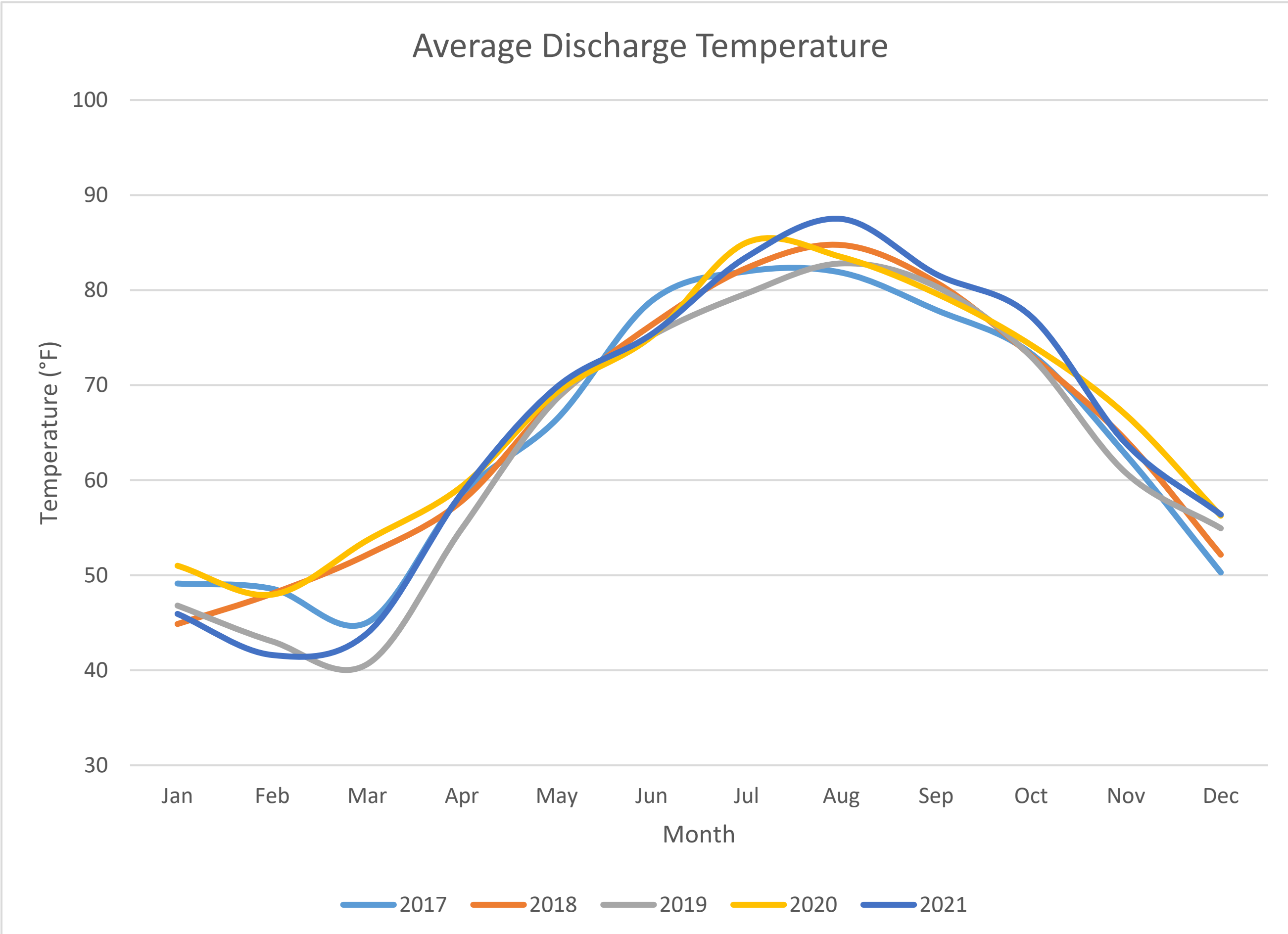


Figure 3.6-4 Average Discharge Temperatures

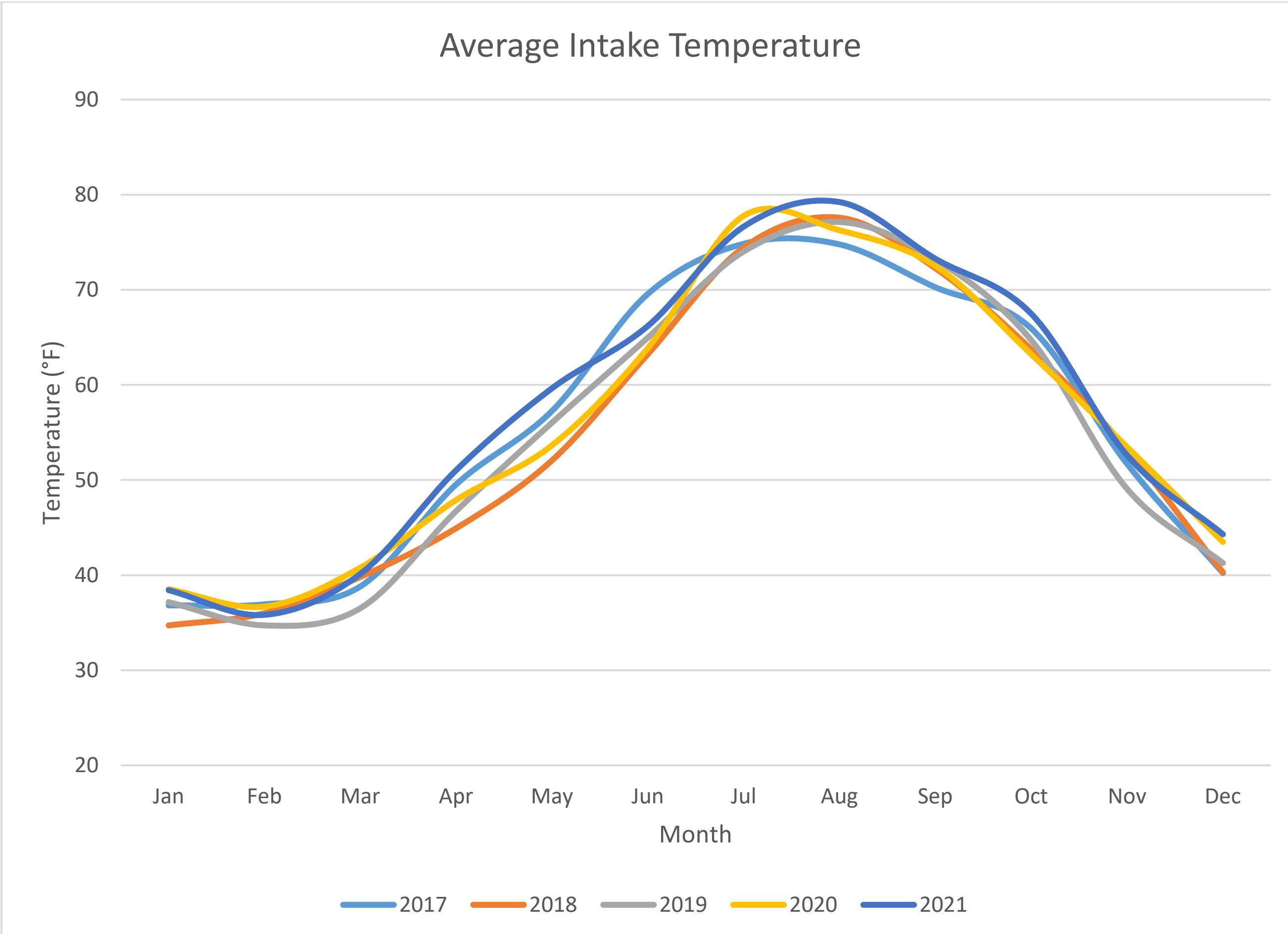


Figure 3.6-5 Average Intake Temperatures

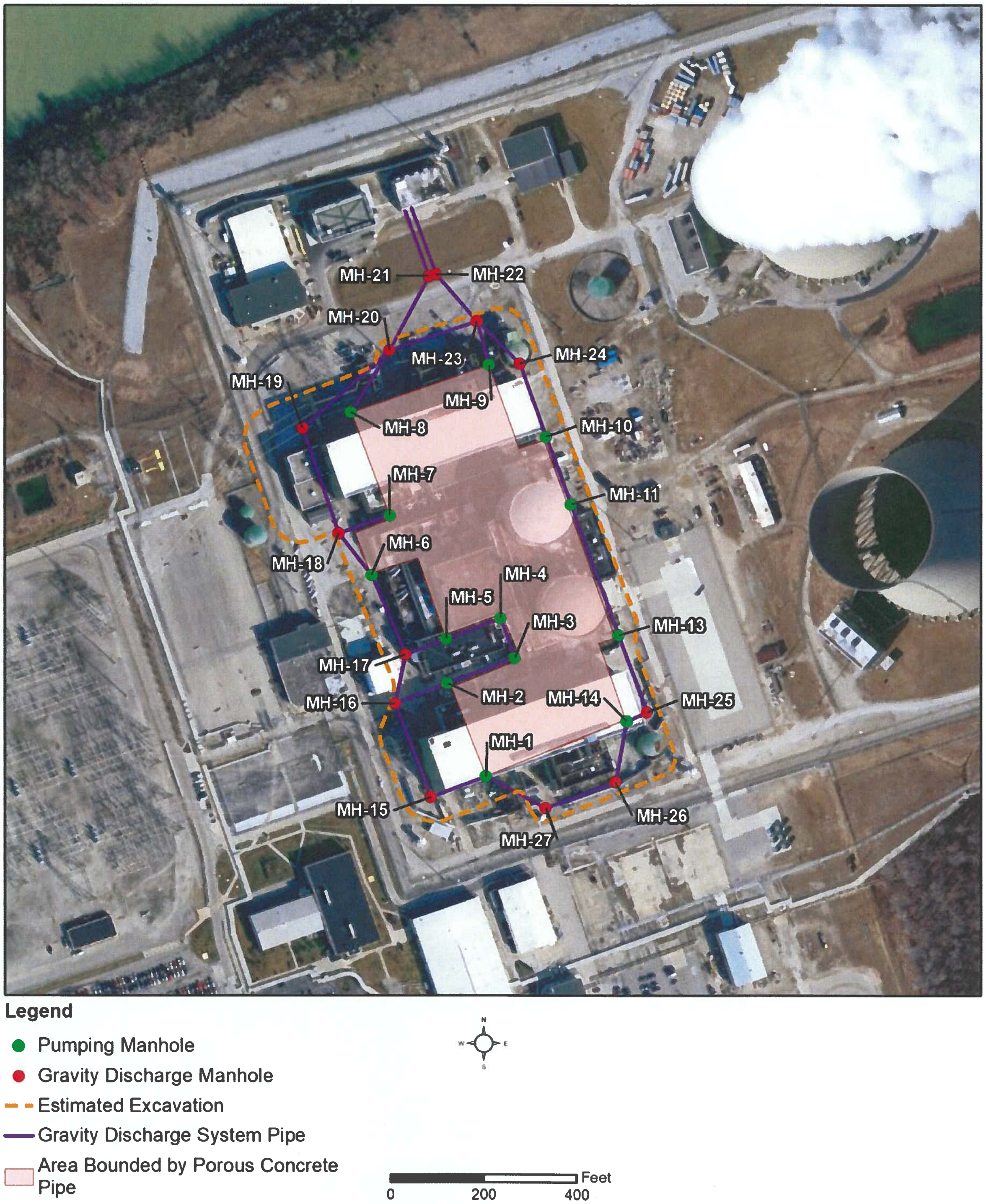
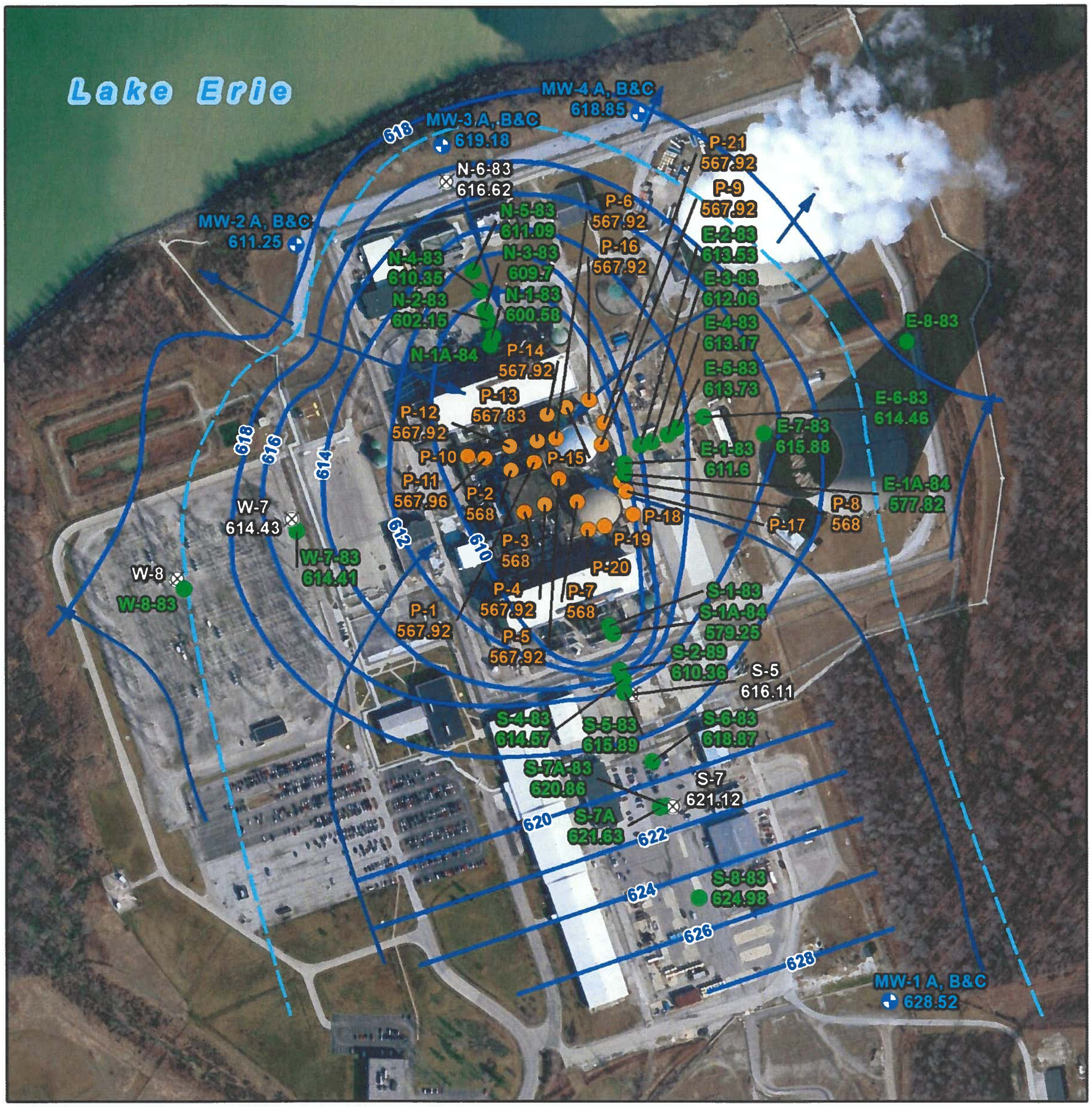


Figure 3.6-6 Underdrain System Map

Figure 3.6-7 Onsite Wells



Legend
- Monitoring Well
- Historic Monitoring Piezometer, Indoor
- Historic Monitoring Piezometer, Outdoor
- Damaged Historic Monitoring Piezometer
- Groundwater Flow Direction in Glacial Lacustrine Deposits
- Groundwater Contour
- Approximate Groundwater Divide/Capture Zone

Feet
0 200 400

Groundwater Monitoring Evaluation 4/2020

Figure 3.6-8 April 2020 Potentiometric Map

Figure 3.6-9 Offsite Registered Water Wells within 2 Miles of PNPP

3.7 Ecological Resources

Regional ecology is greatly influenced by the geomorphic and physiographic characteristics of the region. Soils determine the basic fertility of the region, which in turn determines the types of plants that may grow there. The plants that are present greatly influence the types and number of animals that reside in the region. Soil types also greatly influence the basic fertility of aquatic ecosystems and the species present. Climatological factors such as temperature, day length, and precipitation, further refine the plants and animals that may live in a locale.

3.7.1 Aquatic Communities

This section describes the aquatic environment and biota near the PNPP site and other areas potentially affected by the continued operation of the PNPP. It includes a description of the aquatic ecosystems at or near the site, a description of representative important species that are present or are expected to occur, and the location of state parks, critical habitats, or other areas carrying special designations.

The aquatic environment near the PNPP site is associated with Lake Erie, which is the source and receiving water for the PNPP cooling system. PNPP facilities are located on the southern shore of Lake Erie. Grand River is located within 6 miles of the PNPP site. Grand River flows into Lake Erie approximately 4.75 miles southwest of the PNPP site. Grand River is not expected to influence the aquatic communities at the PNPP site, nor would its aquatic community be influenced by activities on the PNPP site; thus, additional discussion on the ecology of Grand River is not provided.

3.7.1.1 Lake Erie Watershed

The Lake Erie Watershed drains 30,140 square miles of Ohio, Indiana, Michigan, New York, Pennsylvania, and Ontario. Of the five Great Lakes, Lake Erie is exposed to the greatest effects from urbanization and agriculture. The watershed is largely agricultural, intensively industrialized, and highly urbanized. It is intensively farmed due to very fertile soils. The lake receives agricultural runoff from southwest Ontario and from parts of Ohio, Indiana, and Michigan. The Maumee River has the largest drainage basin (6,570 square miles) of any other river system in the Great Lakes Watershed. It drains all or portions of 17 counties in Ohio, five counties in Indiana and two counties in Michigan. Other major tributaries feeding into Lake Erie include the Huron and Raisin rivers in Michigan, the Sandusky, Cuyahoga and Grand rivers in Ohio and the Grand River in Ontario. About 12 million people, or one-third of the Great Lakes Watershed total population, live in the Lake Erie Watershed. The largest metropolitan areas include Detroit, Michigan, Cleveland, Ohio, and Buffalo, New York. The basin is the second largest most densely populated behind Lake Michigan's watershed. (ODNR 2018a)

3.7.1.2 Lake Erie

Lake Erie is the second smallest of the Great Lakes by surface area (9,910 square miles) and the smallest by volume (119 average cubic miles). Lake Erie contains approximately

127.7 trillion gallons of fresh water, which is three percent of the entire Great Lakes volume. Lake Erie is also the shallowest, southernmost and warmest of the Great Lakes. Its primary outflow is the Niagara River, which flows over Niagara Falls and through the Niagara Gorge into Lake Ontario. The lake is approximately 241 miles long and 57 miles wide, with an average depth of 58 feet and a maximum depth of 210 feet. (EPA 2019; GLC 2022; ODNR 2018a)

The surface water monthly temperature ranges from an average of 34°F to 74°F (NOAA 2022c). In winter and early spring, Lake Erie water temperatures are cold and nearly consistent throughout the entire water column. The lake's surface temperatures increase as sunlight is absorbed in late spring and summer. The water in the lake generally circulates in a two-gyre pattern of circulation in winter with a northern gyre circulating in clockwise fashion and a southern gyre circulating in counterclockwise fashion, creating an eastward flow and longshore current along the south shore, where PNPP is located. In general, winter currents in Lake Erie are stronger than summer currents, especially near shore. (NOAA 2005; ODNR 2018a).

Lake Erie is naturally divided into three basins:

- The western basin is very shallow, with an average depth of 24 feet and a maximum depth of 62 feet. It is the most turbid region of the lake as most of the lake bottom is covered with fine sediment particles that are easily disturbed by wind and wave action.
- The central basin is quite uniform in depth, with an average depth of 60 feet and a maximum depth of 82 feet. The PNPP site is located on southern shore of the central basin.
- The eastern basin is the deepest of the three basins, with an average depth of 80 feet and a maximum depth of 210 feet. (EPA 2022d)

Lake Erie's nearshore environmental zone is defined by water depths between 10 and 49 feet. The lakes nearshore zone encompasses vast expanses of open water. This zone is subject to many physical processes, including lake circulation patterns, alongshore currents, sediment transport, waves, and lakebed downcutting. The nearshore provides essential spawning habitat, nursery habitat and feeding grounds for many fish species. The offshore zone is defined by a water depth of 49 feet or deeper. Much of the open-water areas of the central basin are categorized as "offshore." This zone is subject to anoxic, "dead zone" conditions. Fish avoid anoxic water by inhabiting areas above or shoreward of the dead zone, which may not provide suitable or preferred prey. Hypoxic zones hinder fish growth, survival, and reproductive capacity. Many sessile organisms such as mussels die in oxygen-depleted areas. (ODNR 2018b).

Over the years, Lake Erie has suffered from pollution largely due to agriculture, and intensive industrialization and urbanization of the surrounding areas which have threatened its productivity and value as a natural resource (ODNR 2018a). The Ohio Lake Erie Commission has established a set of indicators to track water quality of Lake Erie and to provide direction to the general public. The following indicator ratings were published in the 2004 State of the Lake report for Lake Erie: Ambient Water Quality – *Fair*, Human Exposure Risks – *Good*, Pollution

Sources – *Fair*, Aquatic Habitat – *Poor to Fair*, Biological – *Fair*, Coastal Recreation – *Good*, Boating – *Good*, Fishing – *Good*, Beaches – *Fair to Good*, and Economy – *Fair*. (OLEC 2004)

Fish consumption guidelines have been established by the Ohio Department of Health due to high levels of PCBs and mercury. Consumption guidelines exist for Lake Erie for common carp, smallmouth bass, channel catfish, freshwater drum, lake trout, steelhead trout, white bass, whitefish, white perch, and brown bullhead due to the presence of mercury and PCBs (ODH 2021).

The Lake Erie Unit of the ODNR conducts annual assessments of recreational and commercial fish harvest, abundance of recreationally important and commercially important fish species, abundance of key forage fish, and descriptions of trophic condition of Lake Erie and its tributaries. Fish species recorded in Lake Erie between 1987 and 2020 include: buffalo (*Ictiobus cyprinellus*), black bullhead (*Ameiurus melas*), burbot (*Lota lota*), carp (*Cyprinid* spp.), channel catfish (*Ictalurus punctatus*), freshwater drum (*Aplodinotus grunniens*), American gizzard shad (*Dorosoma cepedianum*), goldfish (*Carassius* spp.), quillback (*Carpiodes cyprinus*), suckers (*Catostomus* spp.), white bass (*Morone chrysops*), smallmouth bass (*Micropterus dolomieu*), white perch (*Morone americana*), lake whitefish (*Coregonus clupeaformis*), walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), rainbow smelt (*Osmerus mordax*), emerald shiner (*Notropis atherinoides*), spottail shiner (*Notropis hudsonius*), alewife, trout perch (*Percopsis omiscomaycus*), and silver chub (*Macrhybopsis storeriana*). Table 3.7-1 provides a list of recreational and commercial fish species recorded in Lake Erie between 1987 and 2020. (ODNR 2021a).

Native migratory fish species such as walleye, lake whitefish and lake sturgeon, utilize different environmental zones of Lake Erie during various life stages. The ODNR has identified four classes of fish habitat in Lake Erie into four zones based on bathymetry and existing fish community (biomass) data: (1) Walleye Larval and Juvenile Production Areas; (2) Adult Walleye Habitat; (3) Walleye and Perch Habitat, and (4) Anoxic/Dead Zone. The area of Lake Erie where the PNPP site is located has been classified as a Walleye Larval and Juvenile Production Area. Such areas are generally found in the shallower (less than 10 feet) and moderately turbid (low clarity) waters of the coastal margin and nearshore zones. Nearshore water warms at a faster rate and offers greater feeding opportunities for young walleye. Dredging, deposition from erosion, changes in tributary flow and water level fluctuations can reduce the extent of nursey/production areas or disrupt the linkage between spawning and nursery habitats. (ODNR 2018b).

Aquatic surveys of Lake Erie in the vicinity of the PNPP site was conducted during the pre-construction phase between 1971 and 1972. No other aquatic surveys have been completed in the vicinity of the PNPP site since then.

A total of 739 fish comprising 16 species and one hybrid form were captured during the 197I-1972 gill-netting procedure at the PNPP site. The catch was dominated by yellow perch (53 percent), freshwater drum (23.5 percent) and walleye. Results of the trawl and gill-net collections in the offshore areas near the intake and discharge structures indicated that freshwater drum, yellow perch, emerald shiner, spottail shiner, rainbow smelt, white sucker (*Catostomus commersonii),* carp, and American gizzard shad were among the species with most potential for interaction with the structures. Fish impingement studies conducted at the Ashtabula C fossil-fueled power plant that withdraws Lake Erie cooling water through an offshore intake system during 1977-1978 showed that 95 percent of the fishes impinged were species listed above. Emerald shiners and young alewives (*Alosa pseudoharengus*) were identified to be the dominant species present nearshore to the PNPP site. (NRC 1982)

Surveys of ichthyoplankton in Lake Erie adjacent to PNPP were conducted during the spring and summer of 1974. The results indicate that cyprinids were the majority of larval fish collected. Eggs collected during the study were mostly those of freshwater drum, yellow perch, troutperch, rainbow smelt, cyprinids, and "other" (unidentified). Young-of-the-year and juveniles alewives, gizzard shad, and shiners were most abundant in shore seine samples. The results of the surveys suggest that the area around the PNPP site was used as a spawning and nursery area by small-bodied, forage species such as shiners, alewife, and gizzard shad. In the 1984 Final Environmental Report, the NRC noted that Lake Erie in the vicinity of the PNPP site is used as a fish spawning and nursey area but does not appear to be unique with respect to the occurrence or abundance of planktonic or juvenile fishes. (NRC 1982)

Lake Erie is a biologically productive lake with yields high levels of nutrients supporting an abundance of aquatic plants, including algae. The lake is shallow and well-mixed—especially in the Western Basin—nutrients are sufficiently circulated and increasingly available to aquatic vegetation (ODNR 2018b). The phytoplankton communities of Lake Erie during the pre-construction surveys between 1971 and 1972 were dominated by *Melosira binderana* and *Cyclotella Kuetzingiana* in spring (April), and by *Coelastrum cambricum, Melosira varians,* and *Fraqilaria capucina, Coelastrum microporum,* and *Mougeotia viridis* in summer (June-July). *Fragilaria capucina* was the most dominant species in late summer sampled collected. The fall phytoplankton community was dominated both in numbers and in biomass by the centric diatom, *Stephanodi*scus *niagarae*. Blue-green algae had decreased in overall importance in the PNPP area and constituted only about 5 percent of the community.

Zooplankton constitute an essential link in the aquatic food chain. The majority of fish species are dependent upon the zooplankton community at least in the early stages of their development. Zooplankton collections were dominated by protozoans and rotifers (84 to 100 percent in samples collected in November 1971, March 1972, and April 1972). Micro-crustaceans (cladocerans and copepods) and rotifers were dominant in samples collected in summer (July, August, and September) 1972. By fall (October 1972), protozoans were the most abundant group, comprising 48 to 63 percent of all zooplankton.

Table 3.7-2 provides a list of phytoplankton and zooplankton recorded at the PNPP site from the 1971-1972 pre-construction surveys.

A total of 54 taxa of benthic macroinvertebrates were identified during the 1971-1972 surveys conducted at the PNPP site. Benthic macroinvertebrates are a vital link in energy transfer from the sediments back into aquatic community of a lake. Of the taxa recorded, 18 percent of 33 percent of all five taxa were oligochaete worms. Twelve taxa (22 percent) were chironomid larvae while eight (15 percent) were insects other than Chironomidae. Mollusks comprised five taxa (9 percent) and crustaceans comprised four taxa (7 percent). Seven other taxa found (13 percent) included Hydra, a planarian, nematodes, entoprocts and ectoprocts, a leech and water mites.

3.7.2 Terrestrial and Wetland Communities

The PNPP site consists of generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. A large portion of the site also consists of undeveloped woodlands with patches of forested wetlands. This section identifies terrestrial and wetland ecological resources and describes species composition and other structural and functional attributes of terrestrial biotic assemblages that could be affected by the continued operation and maintenance of the facilities.

3.7.2.1 Physiographic Province

PNPP is located within the Central Lowland physiographic province of the United States. This province is the largest in the United States and covers 585,000 square miles. It covers all of Iowa and Michigan, and the majority of Oklahoma, Illinois, Indiana, Ohio, Wisconsin, and Minnesota. It stretches into the northern portion of Missouri and the eastern sections of North Dakota, South Dakota, Nebraska, and Kansas. The Great Lakes region of the central lowland physiographic province is the result of repeated glacial scouring, and the shape of the lakes is a result of pre-glacial streams bordering rocks that influenced the direction of the advancing ice (NPS 2018).

3.7.2.2 Ecoregion

PNPP is situated within the Erie Lake Plain ecoregion, which falls within the larger Erie/Ontario Drift and Lake Plain ecoregion (EPA Level III 19 ecoregion). The Erie Lake Plain ecoregion is a level coastal strip of lacustrine deposits with beach ridges and swales. The lake-modified climate separates this region from other nearby ecoregions and the annual growing season is often several weeks longer than more inland areas. Urban-industrial sites, ports, fruit-vegetable farms, and nurseries have developed on the plain. (Woods et al. 1998)

A brief description of the other regional ecoregions within 6 miles of PNPP site is provided below.

3.7.2.2.1 Mosquito Creek/Pymatuning Lowlands

The Mosquito Creek/Pymatuning lowlands ecoregion is made up of moisture tolerant woodlands, low-gradient streams, wetlands, and poor drainage. This ecoregion is nearly flat and underlain by clayey till and fine lacustrine deposits. Dairy farms and woodlots occur today, however originally beech forests were common. (Woods et al. 1998)

3.7.2.2.2 Low Lime Drift Plain

The low lime drift plain ecoregion is distinct from the nearby unglaciated, wooded, hilly country ecoregion with a gently rolling landscape composed of low rounded hills with scattered end moraines and kettles. Many ridges and lowlands are wooded and urban-industrial activity as well as dairy, livestock, corn, and soybean farming are common. The growing season is progressively decreasing as the distance from Lake Erie increases. (Woods et al. 1998)

3.7.2.2.3 Erie Gorges

The Erie Gorges ecoregion is a uniquely steep area along the Chagrin, Cuyahoga, and Grand rivers. Rock exposures occur and fluvial erosion rates are high with local relief sometimes exceeding 500 feet. Today, woodland, recreational areas, scattered farms, and housing are dominate where originally mixed mesophytic forests were common on well-drained sites. (Woods et al. 1998)

3.7.2.2.4 Summit Interlobate Area

The Summit Interlobate Area is set apart from adjacent ecoregions by its numerous lakes, wetlands, sphagnum bogs, sluggish streams, kames, and kettles. The substrate is often sandy outwash and till. Mixed oak forests originally dominated well drained areas; today, woodland, peatland, agriculture, gravel quarries, and urban-suburban development occurs (Woods et al. 1998).

3.7.2.3 Terrestrial Vegetation

Vegetation studies conducted at the PNPP site prior to construction identified the following vegetation types at the site:

- Sugar Maple-Red Oak Forest dominated by sugar maple (*Acer saccharum*) and northern red oak (*Quercus borealis*).
- Beech-Maple Forest dominated by American beech (*Fagus grandifolia*) and sugar maple.
- Mixed Mesophytic Forest dominated by American beech, sugar maple, tulip tree (*Liriodendron tulipifera*), ash (*Fraxinus* sp.), and black cherry (*Prunus serotina*)
- Swamp Forest dominated by ash, spicebush (*Lindera benzoin*), tulip tree, American beech, sugar maple, and red maple (*Acer rubrum*).
- Hemlock-Northern Hardwood Forest dominated by eastern hemlock (*Tsuga canadensis*), yellow birch (*Betula lutea*), American beech, and tulip tree.
- Flood Plain Forest dominated by sugar maple, ash, and black cherry.

Changes to the vegetation communities are likely to have occurred in the last 50 years since the surveys were completed. No recent site-specific vegetation surveys/maps are available for the PNPP site. However, no license renewal-related construction activities or changes in operational practices have been identified that would involve disturbing the vegetation communities at the PNPP site (discussed under Section 4.6.5.4). Details of changes to drainages and wetlands that occurred in 2015 are discussed under Section 3.7.2.4.

3.7.2.4 Wetlands

Wetlands are defined as areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (USACE 1999).

The USFWS maintains the National Wetlands Inventory (NWI), which integrates digital map data along with other resource information to produce current information on the status, extent, characteristics, and functions of wetland, riparian, and deepwater habitats in the United States. Based on a review of USFWS NWI maps of the site (USFWS 2022a), there are approximately 37,331 acres of wetlands within a 6-mile radius of PNPP, composed of the following types (Figure 3.7-1):

- Freshwater emergent wetlands covering approximately 53 acres (0.14 percent of total wetland habitat)
- Freshwater forested/shrub wetlands covering approximately 1,047 acres (2.80 percent of total wetland habitat)
- Freshwater ponds covering approximately 289 acres (0.77 percent of total wetland habitat)
- Lakes covering approximately 35,537 acres (95.19 percent of total wetland habitat)
- Riverine waters covering approximately 405 acres (1.08 percent of total wetland habitat)

The PNPP property is bound by Lake Erie on the northern boundary. Based on the NWI data (USFWS 2022a), a total of 95.13 acres of wetlands, lakes, ponds, and riverine waters are mapped on the PNPP site (Figure 3.7-2). Several mapped drainages transverse the PNPP site flowing northwest to wetlands or Lake Erie.

Based on the NWI data, the following wetland water types are located on the PNPP site:

- Freshwater emergent wetlands covering approximately 3.23 acres (3.4 percent of total wetland habitat)
- Freshwater forested/shrub wetlands covering approximately 72.77 acres (76.50 percent of total wetland habitat)
- Freshwater ponds covering approximately 2.4 acre (2.52 percent of total wetland habitat)
- Lakes covering approximately 2.99 acres (3.14 percent of total wetland habitat)
- Riverine waters covering approximately 13.75 acres (14.45 percent of total wetland habitat)

A wetland delineation at the PNPP site was conducted in 2014. Nine wetlands totaling to 39.197 acres were identified and delineated within the PNPP site. A total of 1.916 acres were classified as palustrine emergent or palustrine scrub-shrub, and 37.281 as palustrine forest wetlands.

PNPP received a CWA Section 404 permit (2014-00108) from the USACE for impacts to 4.944 acres of wetlands and 3,242 linear feet of stream at the site in 2015. The impact was a result of construction of a new stream channel that diverted water from the existing stream to prevent flooding of PNPP.

3.7.2.5 Terrestrial Animal Communities

The terrestrial community at PNPP consists of wooded areas interspersed with development. Wildlife species found, primarily within the wooded areas, are those typically found in the Lake Erie ecological landscape. Terrestrial species that are federally and/or state listed as endangered or threatened and known to occur in the vicinity of PNPP are discussed in detail in Section 3.7.8. Suitable habitat likely exists within the vicinity of PNPP for the following protected species: Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septentrionalis*), eastern massasauga (*Sistrurus catenatus*), spotted turtle (*Clemmys guttata*), monarch butterfly (*Danaus plexippus*), black-crowned night-heron (*Nycticorax nycticorax*), upland sandpiper (*Bartramia longicauda*), lark sparrow (*Chondestes grammacus*), northern harrier (*Circus hudsonius*), bald eagle (*Haliaeetus leucocephalus*), least bittern (*Ixobrychus exilis*), piping plover (*Charadrius melodus*), and red knot (*Calidris canutus rufa*).

Terrestrial fauna species likely to be observed in Lake County are listed in Table 3.7-3.

Mammals commonly suited to the habitat surrounding the PNPP site and those that have been observed during pre-construction surveys include white-tailed deer (*Odocoileus virginianus*), Virginia opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), eastern cottontail rabbit (*Sylvilagus floridanus*), striped skunk (*Mephitis nephitis*), woodchuck (*Marmota monax*), eastern chipmunk (*Tamias striatus*), red squirrel (*Tamias ciurus hudsonicus*), eastern fox squirrel (*Sciurus niger*), deer mouse (*Peromyscus maniculatus*), and white-footed mouse (*Peronyscus leucopus*).

Amphibians likely to inhabit the PNPP site and its surrounding areas include northern leopard frog (*Lithobates pipiens*), spring peeper (*Hyla crucifer crucifer*), Blandchard's cricket frog (*Acris crepitans blanchardi*), western chorus frog (*Pseudacris triseriata*), green frog (*Rana clanitans*), and northern dusky salamander (*Desrnognathus fuscus fuscus*). Reptiles include eastern garter snake (*Thamnophis sirtalis sirtalis*), snapping turtle (*Chelydra serpentina*), and spotted turtle (*Clemmys guttata*).

Bird populations on the PNPP site include year-round residents, seasonal residents, and transients (birds stopping briefly during migration). Year-round residents include Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), sharp-shinned hawks (*Accipiter striatus*), mourning doves (*Zenaida macroura*), downy woodpeckers (*Picoides pubescens*), black-capped chickadees (*Poecile atricapillus*), tufted titmice (*Baeolophus bicolor*), and northern cardinals (*Cardinalis cardinalis*). No avian surveys have been conducted at the PNPP over the last five years; however, it is known that peregrine falcons (*Falco peregrinus*) nest onsite.

Bird populations on the site are representative of those found in the region. While there are resident bird populations, the region also serves as a pass-through area for semi-annual migrations of neotropical birds that may range between South America and Canada, as well as seasonal migrations of waterfowl. The PNPP site is located within the Mississippi flyway, a major migratory route for birds during the spring and fall. The Mississippi flyway extends from the Arctic Circle down to the Gulf Coast of Louisiana, Mississippi, and Alabama. Migrating birds often fly these routes at night and land to rest early in the morning. Before dawn they seek out suitable habitat, called stopovers, in which to feed and avoid predators. Large natural barriers such as mountains and deserts, or large bodies of water create especially crowded stopovers. These stopovers are very important because the flight over the barrier will mean a long stretch without any opportunity to stop for food, rest, or cover. Along the Mississippi flyway, the Hudson Bay and the Great Lakes are major barriers. Numerous species of migratory birds likely use the project corridor during the spring and fall migrations, as summer residents, and as winter visitors. According to the USFWS, 16 migratory birds have the potential to occur in the vicinity of the PNPP site: bald eagle, black-billed cuckoo (*Coccyzus erythropthalmus*), blue-winged warbler (*Vermivora pinus*), bobolink (*Dolichonyx oryzivorus*), Canada warbler (*Cardellina canadensis*), Cerulean warbler (*Dendroica cerulea*), evening grosbeak (*Coccothraustes vespertinus*), golden eagle (*Aquila chrysaetos*), golden-winged warbler (*Vermivora chrysoptera)*, lesser yellowlegs (*Tringa flavipes*), long-eared owl (*Asio otus*), prairie warbler (*Dendroica discolor*), red-headed woodpecker (*Melanerpes erythrocephalus*), ruddy turnstone (*Arenaria interpres morinella*), short-billed dowitcher (*Limnodromus griseus*), and wood thrush (*Hylocichla mustelina*) (USFWS 2022b).

3.7.2.6 Transmission Lines

Physical features (e.g., length, width, route) of each of the in-scope transmission lines are described in Section 2.2.5.1. All in-scope transmission lines are located completely within the PNPP site, as shown in Figure 2.2-2.

The in-scope transmission lines overlap with the critical habitat for the piping plover. The risk of collision with in-scope transmission lines poses a potential threat to piping plovers. There are no site-specific avian protection plans or mitigation measures in place for PNPP; however, Energy Harbor maintains records of bird mortality and nesting within the PNNP site. Between 2017-2021 there were seven condition reports relating to bird mortality and nesting. None of the dead birds recorded in the condition reports were identified to be piping plovers.

The transmission lines cross the PNPP industrial area, where vegetation is sparse and only minimal vegetation management is required. The in-scope transmission line corridors consist primarily of developed land (substation/switchyard); however, some vegetated areas are crossed, consisting of maintained grass with some trees and shrubs. There are no site-specific procedures regarding maintenance of vegetation under the in-scope transmission lines at the PNPP site. Control methods are based on environmental impact and anticipated effectiveness, along with site characteristics, security, economics, current land use, and other factors. These methods include, but are not limited to pruning, removal, herbicide application, and mowing. All vegetation-related work will comply with the following industry standards: ANSI Z133.1-2012 safety requirements for arboricultural operations; OSHA 1910.269 electric power generation, transmission and distribution; ANSI A300 (Part 1) 2012 pruning for tree care operations–tree, shrub, and other woody plant maintenance–standard practices; and ANSI A300 (Part 7) 2012 IVM tree, shrub, and other woody plant maintenance standard practices (integrated vegetation management approach for electric utility rights-of-way). PNPP has site-specific procedures for the application of herbicides and pesticides to control vegetation under in-scope transmission lines.

3.7.3 Potentially Affected Water Bodies

The major water resource in the vicinity of PNPP is Lake Erie. Water from the lake is used for Service Water and ESW, once-through systems that remove heat from plant loads. PNPP is located on the southern bank of Lake Erie in Lake County, Ohio. Lake Erie is the smallest of the Great Lakes by volume (116 cubic miles). The lake covers 9,910 square miles and drains a land area of 30,140 square miles (EPA 1995; EPA 2019). The PNPP site lies within the Erie Lake Plain which is a narrow strip of low-lying land along Lake Erie that's characterized by beach ridges and high coastal bluffs. (ODNR 2018b)

For steam condensation, PNPP circulating water utilizes a closed-cycle cooling system that draws water from and discharges to Lake Erie. Cooling system blowdown is returned to Lake Erie through a single discharge tunnel to a discharge structure from shore to the lake bottom. Water is taken from Lake Erie by intake structures located approximately 2,600 feet offshore and 13.3 feet below the surface of the lake based on low water datum level at Elevation 570.5' USGS. A 10-foot inner diameter intake tunnel conveys the water to two onshore pumphouse structures. Intake structures and the discharge nozzle have been sized to carry a normal flow 45,400 to 70,500 gpm. Intake velocity will vary from approximately 0.5 to 0.7 feet per second (fps). (EH 2021a) To prevent pump fouling, two traveling screens (width of tray is 6' and screen openings are 0.375") (EH 2021a) are used. Lake water passes through the traveling screens ahead of the emergency service pumps. A screen wash pump supplies high pressure water to clean the traveling screens. The emergency service pumps discharge to Lake Erie via the plant discharge tunnel where the discharge is well mixed with the lake water. The offshore discharge structure consists of a submerged 3-foot diameter steel diffuser nozzle. (EH 2021a)

The screen wash system includes the two traveling screens, motor-operated strainers, and screen wash pumps to provide for removal of debris from the traveling screens so that Lake Erie water is filtered before it enters the emergency service water pumps. (EH 2021a) Because of the design features of the intake-discharge structures, it is highly unlikely that any significant amount of debris will enter the ESW pumphouse and clog the screens. Screen wash pumps have a design pressure of 225 psi (EH 2021a)

PNPP utilizes a once-through service water system that supplies lake water to the unit for cooling the turbine building closed loop heat exchangers, the turbine lube oil coolers, and the nuclear closed cooling heat exchangers. The system also supplies water to the screen wash pumps. Service water is obtained from Lake Erie at approximately 2,600 feet offshore and carried to the plant site through a 10-foot inner diameter intake tunnel located in the underlying bedrock. The water is returned to the lake through a similar discharge tunnel. (EH 2021a). The amount of water not required for makeup is returned to the lake by way of the discharge tunnel water return line (EH 2021a). The service water system is non-safety-related and is not required for the safe shutdown of the reactor. The system is, however, necessary for the operation and orderly shutdown, without damage to the equipment, of the balance of the plant. (EH 2021a)

PNPP cannot operate without the intake and discharge of cooling water, which directly impacts Lake Erie. The NRC is responsible for authorizing the operation of nuclear facilities, as well as approving any extension of an initial operating license through the license renewal process. Intake and discharge of water through the cooling water system would not occur but for the operation of the facility pursuant to a renewed license. The effects of the proposed federal action—the continued operation of PNPP, which necessarily involves the removal and discharge of water from Lake Erie—are therefore shaped by the NPDES permit issued to the plant. The current NPDES permit was effective as of February 2021, with an expiration date of February 28, 2023.

3.7.4 Places and Entities of Special Ecological Interest

3.7.4.1 Headlands Dunes State Nature Preserve

Headlands Dunes State Nature Preserve is one of the last of the sandy beaches and dunes left in Ohio. This Preserve is located approximately 6.7 miles west-southwest of PNPP. Along with the sand and shoreline there are an assemblage of specialized plants and animals occurring in this hostile environment. Switchgrass and/or beach grass are the most important dune developers. These grasses establish on the upper beach and quickly spread into huge root-like mats. Sand will drift in the vicinity of the switchgrass crown, and deposition will occur. The dune becomes stabilized by these grasses which will then bring grape vines and poison ivy. Eventually cottonwood and willow appear and finally oak which is usually black oak (ODNR 2022c).

3.7.4.2 Lakeshore Reservation

Lakeshore Reservation is a park in North Perry, Ohio, approximately 1 mile northeast of the PNPP along the shore of Lake Erie. The park has been classified as a Lakes Metropark by the ODNR. The land was acquired between 1967 and 1973 from the U.S. Bureau of Outdoor Recreation through the Land and Water Conservation Fund. Some of this land was owned by Charles Irish, a well-known arborist who planted various non-native ornamental trees and shrubs amidst the native trees. The park offers camping, fishing, and five trails totaling about 2 miles (LMP 2022a).

3.7.4.3 PNPP Woods Conservation Site

The ODNR has classified the eastern portion of the PNPP site as a conservation site. A conservation site is an area deemed by the Natural Heritage Program to be a high quality, natural area not currently under formal protection. The area may harbor one or more rare species, be an outstanding example of a plant community or have geologically significant features, etc.

3.7.5 Invasive Species

This section contains the occurrences of aquatic and terrestrial invasive species in the vicinity of the PNPP site or in Lake County. Energy Harbor conducts periodic surveys to monitor mussel settlement in plant systems during spawning season in Lake Erie. Energy Harbor does not have any other procedures for monitoring or control of invasive species. However, PNPP maintains the wetlands and controls the invasive plant species growth on the east side of the plant at the location of the new Minor Diversion Stream in compliance with Ohio EPA and USACE requirements.

The ODNR maintains a list of invasive aquatic plant and animal species, which are discussed below (OSU 2018).

3.7.5.1 Invasive Aquatic Plants

Brittle naiad (Najas minor)

Brittle naiad is a submerged aquatic herb native to Europe and Asia. It was first reported in the United States in the Hudson River in 1934 and is now found throughout Ohio. Growth is compact and bushy, with dark green, pointed, serrated leaves that are 1 mm wide and 0.5-3.5 cm long. The species forms thick mats that shade out other native plant species, reducing the recreational and aesthetic value of lakes, ponds, and rivers. Brittle naiad prefers calm waters but may also be found in streams and rivers. It can occur at depths of up to 5 m and tolerate water temperatures over 8 degrees Celsius (°C). The species is spread by seeds and fragmentation. Its fragile stems can easily break into smaller pieces and cling to boats, equipment, and waterfowl, allowing it to spread to new locations. Waterfowl can spread the species by eating and excreting the seeds unharmed. (OSU 2018)

Common reed (Phragmites australis)

Phragmites is a perennial grass abundant along the borders of lakes, ponds, and rivers, in brackish and freshwater marshes, on roadsides and in disturbed areas. Stems are rigid and reach 4.6 m. Leaves are long and pointed. Flowers grow in bushy, purple or golden panicles. Seeds are hairy. Stems form underground network of roots including rhizome runners, which can grow 3 m in a season. The species can spread vegetatively through the runners, including fragments which break off. Phragmites is native to North America, however, a non-native strain from Europe was introduced in the late 1800s, has aggressively expanded throughout the lower 48 states and southern Canada, replacing much of the native strain. Both native and non-native strains are found in Ohio. Phragmites forms dense stands which block light to other plants and releases an allelopathic toxin, which allows it to outcompete native species. It forms dense stands, altering marsh hydrology and wildlife habitat, while increasing fire potential. (OSU 2018)

Eurasian watermilfoil (Myriophyllum spicatum)

Eurasian watermilfoil is an aquatic plant that has feather-like leaves and can grow between 1-3 m long. Stems of the plant can vary in color between green, brown, or pinkish white. Eurasian watermilfoil can easily be confused with native species with similar appearance. However, it can be distinguished from native species by having more than 14 leaflet pairs per leaf and by the fact that it does not produce buds during the winter. The plant typically flowers twice a year, with yellow flowers that rise 5–10 cm above the water surface. Plants automatically break into fragments post-flowering. New roots are produced at nodes along the stem and then the plant fragments at these nodes, allowing the plant to disperse. This species can produce seeds, but typically spreads via vegetative roots and fragments. Although the plant will die back before winter, the roots are capable of surviving until the following spring when it regrows when the water reaches approximately 60°F. (Pfingsten et al. 2022) Eurasian watermilfoil likely spread and became invasive due to the aquarium and aquatic nursery trade. However, this species is largely spread through transport on boating equipment. Ecologically, this species outcompetes native species and reduces the presence of other species. It often grows before other species can germinate and creates dense canopies that reduce light penetration and kill native species below. Eurasian watermilfoil grows in high densities and reduces invertebrate abundance and therefore reduces food resources for fish. The density of the species and the mats it can produce when it dies reduces oxygen levels in the water. Economically, it can clog water intakes, foul beaches, and disrupt the fishing and boating industry. (OSU 2018)

Flowering-rush (Butomus umbellatus)

Flowering-rush is a perennial aquatic herb that can grow both along shorelines and submersed in lakes and rivers. It is native to Europe and Asia and was introduced to North American as a garden plant. It requires wet soil and is intolerant of shade. It prefers shallow and slow-moving waters, such as ditches, marshes, lakes, and streams. As an emergent plant, it can grow up to 0.9 m with stiff, narrow, green leaves, which are twisted at the tips. Flowers grow in umbels on emergent plants, and are typically white, pink, or purple. Stems have a triangular cross-section. It is spread underground by rhizomes, vegetatively by root pieces, and by seeds. Wildlife, water, and boaters can spread it to new locations. Flowering-rush can crowd out native species, destroying food sources and habitats. It can also interfere with activities such as swimming and boating. (OSU 2018)

Moneywort (Lysimachia nummularia)

Moneywort is a creeping perennial with thin vines, yellow flowers, and oval-shaped opposite leaves which have scattered, red to black dots. The stems can reach 0.6 m long, and leaves reach 0.6-4 cm in length. It grows in moist, rich, shaded areas, such as floodplain forests, swamps, stream banks, and roadside ditches. Moneywort is native to Europe and southwest Asia. It was introduced in the United States as an ornamental and is now found throughout the country. Seeds are spread by water and human activities. Moneywort may also spread through creeping stems. It forms dense mats which are a nuisance to gardens, pastures, and lawns. (OSU 2018)

Narrowleaf and hybrid cattails (Typha angustifolia, Typha x glauca)

Narrowleaf cattail is an aquatic perennial that grows in wetland areas, producing distinct brown spikes of flowers. While broadleaf cattail (*Typha latifolia*) is native to the United States, narrowleaf cattail (*Typha angustifolia*) was introduced from Europe, and where the two species occur together, they may hybridize. Cattails are found in wetland habitats, lakeshores, river backwaters, and roadside ditches. Seeds are dispersed by wind and may remain viable for up to 100 years. The species also spreads via underground roots. Stalks are light green, stiff, and round, and grow up to 3 m tall. Leaves are long and narrow (5-15 mm) Invasive cattails may be distinguished from natives by clear separation of the lighter brown male flowers above the green female flowers. Invasive and hybrid cattails dominate shorelines, displacing native plants important for waterfowl and other wildlife. (OSU 2018)

Purple loosestrife (Lythrum salicaria)

Purple loosestrife is a perennial herb native to Europe and Asia. It was brought to North America in the early 1800s for ornamental and medicinal uses. It is widespread in the United States and throughout Ohio. Purple loosestrife grows in clusters of square woody stems, green to purple in color. Stems can grow up to 3 m high. Leaves are lance-shaped and stemless, and sometimes covered in fine hair. Flowers are pink to purple-red and grow in long spikes. Purple Loosestrife spreads quickly, outcompeting and replacing native grasses and plants which provide food and habitat to wildlife. It forms dense stands which restrict native wetland plants and alters the structure of wetlands. (OSU 2018)

Reed canary grass (Phalaris arundinacea)

Reed canary grass is a large perennial native to Europe and some parts of Asia and the United States. The Eurasian ecotype is more aggressive and is widespread in the United States and throughout Ohio. Stems are hairless, hollow, 1 cm in diameter, and have some reddish coloration near the top. The plant grows up to 2.7 m. leaves are 9-25 cm long, flat, and rough. Flowers are dense panicles, 7.5-15 cm in length, arising high above the leaves. They are green to purple and change to beige over time. Reed canary grass occurs in saturated soils of wetlands, roadside ditches, river dikes, levees, and meadows. It may spread through creeping rhizomes, or seeds carried by waterways, animals, humans, or machines. Reed canary grass spreads rapidly and forms large monotypic stands that exclude other plants and are of little use to wildlife. (OSU 2018)

3.7.5.2 Invasive Aquatic Animals

Asian clam (Corbicula fluminea)

Asian clams were first introduced to the United States in 1938 via the Columbia River in Washington State (Foster et al. 2022). Asian clams are small, lightly yellow green to light brown bivalves that average 25 mm in length but can be as large as 65 mm long. This species both reproduces and reaches sexual maturity very rapidly. Individuals can be capable of reproduction within several months. They are also capable of reproducing by self-fertilization. The average life span of individual clams is between two and four years, but they can live up to seven years. Asian clams can be found in various water sources such as lakes and streams but prefer habitats with high levels of dissolved oxygen and substrate consisting of sand or clay where they can be found on or buried just below the sediment. The main threat to PNPP from Asian clams stems from damage to pipes from clogging, where clams accumulate to such an extent that discharge from or intake into pipes is blocked. Asian clams can easily outcompete native species for food resources and habitat, as well as alter substrate. (Foster et al. 2022)

Faucet snail (Bithynia tentaculata)

The faucet snail is an aquatic snail native to Europe, introduced to the Great Lakes in the 1870s. It is commonly found in freshwater ponds, shallow lakes, and canals. It attaches to gravel, sand, clay, mud, or rocks in the fall and winter, and aquatic plants in spring and summer. It can be found in depths of up to 5 m. Adults can grow up to 12-15 mm in length. The shell is shiny, oval and ranges from light brown to black. The spire is relatively large and rounded, consisting of five to six somewhat flattened whorls. The faucet snail can spread by attaching to plants, equipment, and watercraft, and can live in live wells, bait buckets, and bilges. It can live up to a month in dry mud. Faucet snails compete with native snails and can clog water intakes. It is also an intermediate host for three intestinal trematode parasites that can kill waterfowl. (OSU 2018)

Fishhook waterflea (Cercopagis pengoi)

The fishhook waterflea is a tiny predatory freshwater crustacean native to Europe and Asia. It was introduced to the Great Lakes via ship ballast. Fishhook waterfleas have a transparent body about 10 mm in length. Its barbed tail is angled at 90° and makes up about 80 percent of its body length. It is typically found in the upper layer of deep, open water. It can tolerate a wide range of temperatures from 8-30°C. Adults and their eggs can be spread to new waters by fishing, boating and recreational equipment. Females can reproduce in the absence of males, parthenogenically producing eggs that are genetic copies of the mother. Fishhook waterfleas prey on native plankton, competing with juvenile and small fish for food. Their long, barbed tails can clog fishing lines, nets, trawls, and other commercial and recreational equipment. (OSU 2018)

Quagga mussel (Dreissena bugensis)

Quagga mussels were introduced to the United States from Ukraine through the Great Lakes via ballast water from transoceanic vessels. They are small bivalves that are slightly larger than zebra mussels, reaching lengths of 4 cm. Color patterns on the shells can vary from black to white to cream bands that have dark concentric rings. Reproduction is similar to that of the zebra mussel (Benson et al. 2022). Females produce eggs which are released into the water column and fertilized by males. Larvae emerge after 4-5 days and remain free-floating in the water currents until they develop enough to settle to the bottom and begin searching for a substrate to attach to. Females are typically sexually mature in their second year. Ordinarily, individuals live between four to five years (Ianniello 2013). These mussels prefer freshwater with very low salinity levels and temperatures below 82°F. Quagga mussels can attach to both hard and soft substrates but are generally not found near shorelines due to too much wave motion. They can be found at various depths down to 13 m depending on water temperature.

Phytoplankton are their primary food source, which they obtain by filtering water (Benson et al. 2022). Quagga mussels have similar economic and ecological impacts as zebra mussels. However, they have largely displaced zebra mussels in offshore areas of Lake Michigan, and they now have a more extensive distribution and abundance in the Great Lakes than the zebra mussel. They reduce the amount of food available and therefore outcompete many native mussel species, which also reverberates up the food chain as it removes food sources from other species, including fish. By removing phytoplankton and filtering the water, they change the clarity of the water, increasing light penetration. This alters the ecosystem by encouraging the growth of vegetation. Quagga mussels also produce waste that as it is broken down and decomposes, reduces available oxygen. They colonize rapidly and have been known to attach in high densities in pipes and on intake screens, reducing water flow and intake capabilities in many nuclear and hydroelectric plants (Benson et al. 2022).

Rusty crayfish (Faxonius rusticus)

Rusty crayfish are large (8-13 cm) grayish green to reddish-brown crayfish. They are native to Kentucky, Tennessee, Illinois, and Indiana, and western Ohio. They are considered invasive in Michigan, Missouri, Iowa, New Mexico, New York, New Jersey, Pennsylvania, New England, parts of Canada, and eastern Ohio. Rusty crayfish are aggressive, competing with native crayfish for food and hiding locations, and voracious eaters, destroying aquatic plants beds and reducing food, shelter, and spawning sites for other organisms, including valued sport fish. (OSU 2018)

Spiny waterflea (Bythotrephes longimanus)

The spiny water flea is a tiny crustacean native to northern Europe and Asia. It is believed to have been introduced into the Great Lakes through ship ballast water and from sediment in ballast tanks. Spiny water fleas range in length from 0.25–0.6 inches long. They have a long tail that is twice as long as their bodies, with one to three pairs of barbs. The tail has a kink in the middle if the flea was produced asexually, while fleas without the kink are produced sexually. They also have a distinctive black eyespot. One of the characteristics that make spiny water fleas successful invaders is their ability to reproduce rapidly. The form of reproduction depends on the season and water temperature, as they can reproduce both sexually and asexually. Asexual reproduction takes place during the spring and summer. Sexual reproduction occurs in the fall when fertilized eggs that are resistant to drying and freezing are released, which then hatch during the spring. The spiny water flea is typically found in the upper water column of temperate lakes, where they are most abundant during the summer and fall. Their preferred conditions are water temperatures between 50-75°F with salinity levels between 0.04-0.4 parts per thousand. However, they can tolerate temperature ranges between 39-86°F and salinity levels between 0.04-8.0 parts per thousand. (Liebig et al. 2022; MNDNR 2022a)

Spiny water fleas are voracious predators, eating up to 75 percent of their body weight each day by preying on zooplankton. The spiny water flea can disrupt the zooplankton community structure in lakes. They prey on native zooplankton and cause the decline or elimination of zooplankton species. They directly compete with larval fish who also rely on zooplankton. Spiny water fleas provide a food source for some fish, but native species are often unable to eat them because of their long tails and spines. Fishermen often encounter them because they foul fishing gear by getting hooked on fishing lines. They can be observed on fishing line in clumps that resemble a gelatinous blob. (Liebig et al. 2022; MNDNR 2022a)

Zebra mussel (Dreissena polymorpha)

Zebra mussels were first introduced into the United States from the Black Sea to the Great Lakes. They are native to seas and rivers between eastern Europe and western Asia. Zebra mussels are small bivalves that are no larger than 50 mm long and named for the pattern on their shells; however, colors of the shell can vary, having only light or dark shells with no markings. Reproduction usually occurs during the spring or summer. Females produce approximately 40,000 eggs which are released into the water column and fertilized by males. Up to one million eggs can be produced per female during the spawning season. Larvae emerge after 3 to 5 days and remain free floating in the water currents until they develop enough to settle to the bottom and begin searching for a substrate to attach to. Adults are sexually mature when they reach 8–9 mm in length. Individuals typically live between three and nine years. Zebra mussels prefer habitat conditions with optimal temperatures between 68–77°F, although they can tolerate a range of conditions and have shown growth in temperatures as low as 43°F. They feed on algae by efficiently filtering as much as 1 liter of water per day per individual. (Benson et al. 2020)

Zebra mussels have spread to many waterways due to their free-floating larval form. Larval mussels then mature and attach to boats by threads and are easily transported to other waterways. They cause significant damage and problems because of their biofouling capabilities. They colonize rapidly and have been known to attach to surfaces in high densities, such as in pipes, reducing water flow and intake capabilities in many nuclear and hydroelectric plants. They also disrupt the natural ecosystems they invade. They reduce the amount of food available and therefore outcompete many native mussel species, which also reverberates up the food chain as it removes food sources from other species including fish. Zebra mussels also affect native mussels' species by directly attaching to them and restricting their ability to survive. (Benson et al. 2020)

Alewife (Alosa pseudoharengus)

Alewife are a small herring species that can grow up to 35 cm in length. They are typically bluish to greenish with a dark back and light sides that have horizontal dark stripes (Fuller et al. 2021). Alewife reach sexual maturity when they are approximately 11 cm long. This species overwinters in deep water and returns to shallower lake waters in the spring to spawn. Alewife in Lake Michigan have been documented spawning at temperatures between 60 and 82°F. Juveniles prefer waters near 90°F, which are found at shallower depths. Juveniles tend to move farther from the shore as they age. After spawning, adults return to open waters away from the shore, but avoid the deeper cold waters and remain in the mid to upper depths of the lake. The temperature tolerance limits of alewife are a minimum low temperature of 37°F and a maximum high temperature of 93°F. Alewife feed on zooplankton and can often be found schooling diurnally.

Alewife populations were dominant in Lake Michigan during the 1950s and 1960s. Large die offs occurred during this time, fouling beaches, and posing health hazards. Large populations of alewife disproportionately consumed prey in the Great Lakes and altered the zooplankton and phytoplankton populations, further affecting native fish populations. Alewife has contributed to the disappearance of lake whitefish (*Coregonus clupeaformis*) and bloaters (*Coregonus hoyi*) and to the decline of chub species in the Great Lakes. Alewife predation of native fish larvae has contributed to the decline of yellow perch (*Perca flavescens*), deepwater sculpin (*Myoxocephalus thompsonii*), emerald shiners (*Notropis atherinoides*), and lake trout (*Salvelinus namaycush*). Alewife contain high levels of an enzyme that can cause thiamine deficiency and early mortality in species that prey on it. Pacific salmon species were recently introduced into the Great Lakes and have helped to control the alewife population (Fuller et al. 2021).

Common carp (Cyrpinus carpio)

The common carp is native to Eurasia and was first introduced in the United States in the 1800s. Adult fish can be as long as 25 inches and weigh between 20-60 pounds. Carp coloring can vary from olive, gold, reddish brown, to a blackish red on top and from silver to yellowish white below. Tail fins often have red coloring. Age of sexual maturity of the individuals depends on water temperature, with most fish becoming mature between 2-5 years of age. Common carp spawn from April through August, commencing when water temperatures reach 62°F. Females release eggs into shallow areas which are then fertilized by males. The eggs stick to underwater surfaces such as logs or plants and then hatch within 3-16 days. Common carp have a wide range of habitat tolerances and can live in waters that have a range of oxygen, salinity, and turbidity level, but preferred habitats include shallow water with lots of vegetation and little current. When carp inhabit lakes, they will use warmer, shallower water with plenty of vegetation near the edges of the lake. However, during the winter can inhabit areas four to twenty-one feet below the surface of the water. Common carp are omnivorous and feed on a variety of items including invertebrates, plankton, detritus, and vegetation (NS 2022a; Nico et al. 2022). Common carp can negatively affect the habitat where they exist by destroying vegetation and increasing the turbidity of the water. This reduces spawning habitat and water clarity, thereby reducing habitat for species that require clean water and aquatic vegetation. They have also been known to feed on the eggs of other fish, reducing populations of native species. (Nico et al. 2022)

Eastern & western mosquitofish (Gambusia holbrooki, Gambusia affinis)

Mosquitofish are small fish with a flattened head. They are uniform dull grey to brown in color with no barring or banding. They usually have small dark specks on their fins. Females are larger (7.5 cm) than males (3.5 cm) with a hatchet-shaped body. The eastern mosquitofish is native to the Atlantic and Gulf Slope drainages, while the western is native to the lower Mississippi River and Mobile River basins. Both were introduced to Ohio for mosquito control in 1947. All current populations in Ohio are thought to be western mosquitofish. Mosquitofish prefer ponds, wetlands, and backwaters of tributaries with clear water and thick vegetation. In Ohio, they are most widely distributed in large rivers, in calm areas along shorelines. Mosquitofish have high reproductive rates. They eat zooplankton and small invertebrates, altering the food web and displacing native species through direct competition for food and habitat. (OSU 2018)

Goldfish (Carassius auratus)

The goldfish is a freshwater fish native to eastern Asia. It was introduced to North America in the 1600s as an ornamental fish. Introductions were also due to their use as live bait. It is established throughout Ohio. Goldfish have a stout body, typically 10-20 cm in length but can reach as much as 59 cm. The mouth is small, terminal, and lacking barbels. It has a long dorsal fin with 15-24 rays, and hard serrate spines at the origin of both the dorsal and anal fins. Domestic goldfish come in a variety of colors, including orange, yellow, white, black, silver, olive green, greenish-brown, and combinations thereof, while goldfish found in nature are usually a shade of green, brown, or gray. Goldfish prefer a habitat with a muddy bottom and thick vegetation, in freshwater ponds and slow or still waters in depths of up to 19.8 m and prefer temperatures of 4-41°C. Goldfish are believed to be responsible for population declines in many native fish, invertebrate, and plant species. They uproot plants and make waters turbid through their bottom feeding. (OSU 2018)

Grass carp (Ctenopharyngodon Idella)

The grass carp is native to eastern Asia. It was introduced to the United States for aquatic plant control and is now widespread in 45 states and can be found throughout Ohio. It is slender and oblong, between 65-80 pounds, olive to silvery-white. The head is scaleless and lacks barbels. The dorsal fin is composed of three simple rays and seven branched rays. Scales are large with a black spot at the base. Grass carp prefer shallow and quiet waters such as ponds, lakes, and pools and backwaters of large rivers, typically 0.91-3 m deep. Grass carp are voracious eaters, feeding on plants, invertebrates, and algae. They reduce desirable plant species, and the amount of food available to native invertebrates and fish. Excretions can also increase nutrients in the water, leading to harmful algal blooms (HABs). (OSU 2018)

Rainbow smelt (Osmerus mordax)

Rainbow smelt is a small fish native to the Atlantic Coastal and Pacific drainages of North America. It was introduced into Michigan as food for salmon and escaped into Lake Michigan. It is now found in all the Great Lakes, the Mississippi River, and inland waters. When removed from the water, they give off a smell like freshly cut cucumbers. The rainbow smelt has a slender body ranging from 18-23 cm. They are mostly silver, with pale olive-green backs and iridescent sides. The head is elongated with a pointed snout and a protruding lower jaw. It has a single spineless dorsal fin. Rainbow smelt prefer deeper, cooler waters during warm season but favor shallower coastal areas as winter approaches. They can be found in saltwater and freshwater systems. Rainbow smelt compete directly with native sport fish for food. They also feed on early or larval stages of other fish. (OSU 2018)

Round goby (Neogobius melanostomus)

The round goby is native to the Black and Caspian seas and was introduced to the Great Lakes via ballast water from transatlantic vessels. They are mottled with brown and black blotches, have a white to greenish dorsal fin, and can grow up to ten inches in length. One identifying characteristic is a black spot at the base of the dorsal fin. A second identifying characteristic that helps distinguish them from native sculpins are their fused pelvic fins. The fused pelvic fins form a suction disk that helps the fish anchor themselves to substrate when they are in fast moving waters. Round gobies prefer habitat with rocky substrate near the shore but can migrate and survive to deeper waters (50-60 m) during the winter. However, they are capable of surviving in degraded water conditions. Females reach sexual maturity when they are one to two years old, and males reach sexual maturity when they are three to four years old. The spawning season is long and lasts from April through September. Females are capable of producing between 300 to 5,000 eggs. The eggs are laid in nests that are guarded by the males. Round gobies are able to use a food resource that many other species in the Great Lakes cannot eat. They can feed on zebra mussels, with individuals capable of eating up to 78 mussels a day. They will also prey on small fish, eggs, and aquatic insects. This provides them an abundant food source. They also have a well-developed sensory system that allows them to feed in the dark by detecting water movement. This provides them with a significant advantage over native species. (Freedman et al. 2022; Marsden and Jude 2003)

The round goby is known to outcompete native species, particularly the mottled sculpin, for spawning sites and food resources. They have also had a negative impact on lake trout populations in the Great Lakes as they prey on both eggs and young trout. There is also a concern that because round gobies consume zebra mussels, they will transfer contaminants to sport fish that prey on them. Also, birds preying on round gobies are more likely to be infected with avian botulism. (Freedman et al. 2022; Marsden and Jude 2003)

Sea lamprey (Petromyzon marinus)

The sea lamprey is native to the Atlantic Ocean. They may be native to Lake Ontario because of access through the St. Lawrence River which connects to and drains to the Atlantic Ocean.

There is speculation that sea lampreys entered the other Great Lakes through the Welland Canal. Niagara Falls was once a deterrent for the movement of the lamprey, but when the Welland Canal opened for ships to avoid Niagara Falls, it likely opened the pathway for the sea lampreys to inhabit the Great Lakes. It is believed they did not use this pathway until improvements were made to the canal in 1919. Sea lampreys were detected in Lake Erie in 1921 and were abundant in Lake Michigan by the 1930s. Sea lampreys are eel-like in appearance but are primitive jawless fish that grow between 12-20 inches long. They are a grayish blue-black color with metallic violet along their sides and a silvery-white color on the bottom. Sea lampreys are anadromous; they live in marine waters but return to freshwater sources to breed. (Fuller et al. 2020; PSG 2016)

Sea lampreys are parasites with a funnel-like mouth with sharp curved teeth that attach to fish and bore into their skins to feed on blood and body fluid. A single lamprey can destroy 40 pounds of fish during its lifetime. They either kill their hosts outright, or the fish succumb to infections of the wound left by the lamprey. Sea lampreys have had a dramatic negative impact on commercial fisheries, having reduced the catch in Lake Michigan from a high of 5.5 million pounds in 1946 to 402 pounds in 1953. Common prey/host species for sea lamprey in the Great Lakes include large native fish species such as lake trout and walleye, but they are also known to prey on burbot, yellow perch, and white sucker, among other species. In addition to reducing populations of commercial species, the sea lamprey invasion contributed to the extinction of three native species: the longjaw cisco (*Coregonus alpenae*), the deepwater cisco (*C. johannae*), and the blackfin cisco (*C. nigripinnis*). The reduction in large predatory species preyed upon by the sea lamprey led to the invasion of alewife, another problematic invasive species in the Great Lakes. Lampricide use began during the 1950s to combat the invasion of sea lampreys. It has helped reduce the sea lamprey population but requires continual application to keep the population under control. Unfortunately, it has negative effects on native fish and non-parasitic lamprey species. There is also a significant economic cost to purchasing and applying the lampricides. (Fuller et al. 2020; PSG 2016)

White perch (Morone americana)

The white perch is a bass native to the Atlantic coastal regions of the United States. It invaded the Great Lakes through the Erie and Welland canals in 1950 and is now found in all the Great Lakes, as well as inland reservoirs and rivers. It is stocked as a sport fish in many areas of the Mississippi River Watershed. It has a deep, laterally compressed body, averaging 13-18 cm, with a steep slope from the dorsal fin origin to the nose. Color is silvery-gray to greenish brown above, and silvery-white below. It is found in brackish and freshwater rivers, streams, and lakes, in shallow and deep water. It is a prolific competitor of native fish, and feeds heavily on eggs of other fish species. (OSU 2018)

3.7.5.3 Invasive Terrestrial Plants

The Ohio Invasive Species Council maintains a list of 38 invasive terrestrial plant species in Ohio (OIPC 2018a; ODA 2022). The following 15 species are classified as the worst invasive plants of Ohio.

Tree-of-heaven (Ailanthus altissima)

Tree-of-heaven is a dioecious tree reaching 80 feet in height, characterized by an unpleasant odor, described as "burned nut" or "rancid peanut butter". Introduced from China as a garden plant in Philadelphia in 1784, it is now found throughout Ohio. It thrives in disturbed soils, including urban areas. It can invade forests following timber harvests and prescribed burns. Bark is gray to brownish gray to black; leaves are pinnately compound with 11-41 leaflets, and flowers are pale yellow to greenish. Fruits are twisted, winged, and contain a single seed. (OIPC 2018b)

Garlic mustard (Alliaria petiolata)

Garlic mustard is a 2–4-foot biennial herb, introduced from Europe for herbal and medicinal purposes. It is recorded in nearly every county in Ohio. Leaves are triangular and sharply toothed. Crushed leaves emit a garlic-like odor. Flowers are four white petals in clusters at the end of the stem from late April to mid-June. Fruit is a long capsule that splits open to release hundreds of seeds. Seeds are spread by water, humans, and animals. Garlic mustard prefers partial shade in upland and floodplain forests, savannas, pastures, lawns, and roadsides. It invades forest edges and progresses inwards along streams and trails and reduces growth of native wildflowers and fungi that are mutualistic with trees. (OIPC 2018c)

Common barberry (Berberis vulgaris)

Common barberry is a shrub native to Asia, introduced to North American by New England Settlers in the 1600s for ornamental, food, and medicinal uses. Stems are thorny, arched, and can reach 10 feet in height. Leaves are simple, alternate, and lance or egg-shaped, 1-5.5 cm. Flowers are small (8 mm across) and yellow, occurring in drooping racemes. Fruits are red, egg-shaped berries containing one to three seeds. Seeds are spread by animals, especially birds and cattle. Common barberry invades prairies and savannas, sparsely to densely wooded areas, grasslands, and thickets. Common barberry is a host for cereal stem rust (*Puccinia graminis*), a fungus which devastates wheat crops. (Gucker 2009)

Oriental bittersweet (Celastrus orbiculatus)

Oriental bittersweet is a vine native to eastern Asia, introduced to the United States in the 1860s as an ornamental plant. Stems can reach a length of 60 feet. Leaves are rounded, alternate, and finely toothed, up to 4 inches long. Flowers are small and greenish, fruit is a yellow three-valved capsule that splits open, revealing three red-orange seeds. Seeds are dispersed by birds. Oriental bittersweet thrives in disturbed areas such as roadsides, fencerows, forest edges, and forest gaps. It covers large areas of the ground and grows to treetops, reducing sunlight to native plants. (OIPC 2018d)

Spotted knapweed (Centaurea stoebe ssp. Micranthos)

Spotted knapweed is a perennial native to eastern Europe, accidentally introduced to North America through contaminated grain shipments in the late 1800s. Stems 0.3-1.5 m tall grow from a basal rosette of deeply divided oblong leaves. Flowerheads contain 25-35 tubular pink or purple flowers. Fruits are brownish oval achenes 2-3 mm long, dispersed by wind, water, animals, humans, and vehicles. Spotted knapweed infests river and creek sides, roadsides, waste areas, plains, and dry rangelands. It reduces plant species richness and diversity, decreasing forage production, soil fertility, and wildlife habitat. (CABI 2022)

Common teasel (Dipsacus fullonum)

Common teasel is a biennial/perennial native to Eurasia and northern Africa, cultivated in North America for the flowerheads' use as cloth tease in wool manufacturing. It is now found throughout Ohio. Stalks are spiny and can reach 7 feet high, growing from a basal rosette. Flowers are pink or purple, in a dense oval-shaped florescence at the top of the stem. A single plant can produce 3,000 seeds. Common teasel thrives in open disturbed areas such as roadsides and old fields. It invades prairies, meadows, grasslands, and forest openings. (OIPC 2018e)

Russian-olive (Elaeagnus angustifolia) and Autumn-olive (Elaeagnus umbellata)

Russian-olive and Autumn-olive are shrubs/trees that can grow to a height of 30 feet. Autumn-olive is native to China and Japan. Russian olive was first cultivated in Germany. Until recently, both were recommended by the USDA for wildlife planting and windbreaks. Their stems, buds, and leaves have a dense covering of silvery to rusty scales. Autumn-olive has small, oval, dark green leaves, light yellow flowers, and small, round, reddish to pink fruit. Russian-olive has egg to lace-shaped dull green leaves, creamy yellow flowers, and yellow fruit. Both have nitrogen-fixing root nodules, which allow them to adapt to poor soil. They can be found in old field, grasslands, barrens, woodlands, savannahs, roadsides, and disturbed areas. They aggressively outcompete native plants and shrubs. Fruit is primarily spread by birds. (OIPC 2018f)

Hairy willow herb (Epilobium hirsutum)

Hairy willow herb is an herbaceous perennial semi-aquatic plant native to Eurasia and North Africa. It was likely introduced to the United States through ornamental cultivation. Individual plants can grow up to 6 feet tall. The plant has opposite leaves that are 2-5 inches long and 0.5-1 inch wide. Pink flowers 0.75 inches wide with four petals are produced in July or August. This species can reproduce both through seeds and rhizomes. Each plant can produce up to 70,000 seeds that are dispersed by wind. It is believed that the seeds can remain viable for several years in the soil before germinating. Hairy willow herb is tolerant of flooding as it can often be found in water-logged soils, and it is tolerant of semi-shaded areas. The hairy willow herb is an aggressive plant and can easily spread into a variety of different habitats including wetlands and meadows where, once it becomes established, it can form large monotypic stands. Invasion of this species can alter hydrologic regimes, displace native plant species, and degrade wildlife habitat. (CDA 2015; PADCNR 2022)

Glossy buckthorn (Frangula alnus) and European/Common buckthorn (Rhamnus cathartica)

Glossy and common buckthorns are shrubs or trees that can reach a height of 20 feet. They are native to Eurasia and were introduced to the United States as ornamental shrubs and wildlife habitat. Glossy buckthorn has gray-brown bark, oval-shaped shiny green leaves 1-3 inches long, creamy-green flowers, and purple-black fruits. Common buckthorn stems are often tipped with a spine. It has rounded to pointed dark glossy leaves 1-2.5 inches long, 4-petaled yellow-green flowers, and dark purple-black fruits. Common and glossy buckthorn invade open woods, woodland edges, old fields, and roadsides. Glossy buckthorn invades wetlands at a greater frequency. They form dense thickets, displacing native shrubs and herbs. (OIPC 2018g)

Damesrocket/Purple rocket (Hesperis matronalis)

Damesrocket is a perennial or biennial native to Eurasia and introduced to North American in the 1600s. It resembles native phlox, growing up to 3 feet tall from a basal rosette. Leaves are alternate, lance-shaped, and slightly hairy with short or no petioles. Flowers are purple, pink, or white, 4-petaled, up to 2.5 cm long. Fruit is a long silique which splits open to release seeds. It is found in disturbed sites, along roads, railroads, and streams, in open woods, and in thickets. It outcompetes native species and is an alternate host for viruses that affect vegetable and ornamental crop. (Edgin 2017)

Japanese honeysuckle (Lonicera japonica)

Japanese honeysuckle is a semi-evergreen vine introduced in 1806 as an ornamental plant, and as erosion control, cover, and wildlife forage. Stems are hairy and hollow, reaching a length of 30 or more feet. Leaves are opposite, oval-oblong 1.5-3 inches long. Flowers are tubular, with five fused petals, white to pink and turning yellow with age. Fruit is black. Japanese honeysuckle thrives in disturbed areas such as roadsides, fencerows, forest edges, and forest gaps. Seeds are dispersed by birds. Vines limit available sunlight to native plants and weigh down treetops, increasing the likelihood of wind damage. (OIPC 2018d)

Amur honeysuckle (Lonicera maackii), Morrow's honeysuckle (Lonicera morrowii), and Tatarian honeysuckle (Lonicera tatarica)

These three honeysuckles are upright, deciduous shrubs that range from 6-15 feet in height. Amur honeysuckle is native to China, Russia, Korea, and Japan. Morrow's is native to Korea and Japan. Tatarian is native to Russia, Central Asia, and China. They were introduced in the 1700s and 1800s as wildlife cover, soil erosion control, and ornamental plants. Leaves are 1-2.5 inches, short-stalked, and opposite. Amur honeysuckle has dark green, pointed leaves. Morrow's and Tartarian have oval to egg-shaped leaves, and the underside of Morrow's leaves are hairy. Flowers are tubular, paired, and less than an inch long. Fruit are yellow to dark-red berries. They invade woods and forest edges, abandoned fields, prairie remnants, pastures, and other disturbed upland habitats. Morrow's may invade wetlands. Wildlife, especially birds and deer, disperse seeds. These honeysuckles shade out native vegetation. Birds nesting in honeysuckle suffer greater nest predation than those nesting in native shrubs. (OIPC 2018h)

Fig buttercup/lesser celandine (Ranunculus ficaria)

Fig buttercup is a perennial native to north Africa, brought to North America as an ornamental. Stems grow from a basal rosette up to a height of about 1 foot. Leaves are fleshy, dark green, up to 3.5 inches. Flowers are yellow, fading to white with age, ranging from 6-60 petals. Fruits are achenes 3-4 mm long. Fig buttercup may spread vegetatively through spreading tubers, rapidly colonizing new areas. Leaves are toxic to most mammals. Fig buttercup grows in moist, shady areas in forests, as a lawn weed, and in urban areas such as drainages and ditch banks. (Axtel et al 2010)

Multiflora rose (Rosa multiflora)

Multiflora rose is a thorny shrub native to Japan, Korea, and eastern China introduced in the 1800s as a rootstock for ornamental roses, and also used to confine livestock and conserve soil. It is widespread in Ohio. Stems are arching and thorny. Leaves are compound, with 5-11 leaflets. Flowers are white to pink, about 1 inch across. Fruit is small and bright red. Multiflora rose can be found in a wide range of habitats including mesic upland and floodplain woods, forest edges, old fields, savannas, prairies, fens, roadsides, fencerows, and lawns. Multiflora rose can spread vegetatively from root sprouts. (OIPC 2018i)

Black dog-strangling vine, black swallowwort (Vincetoxicum nigrum)

Black swallowwort is an herbaceous perennial twinning vine native to Europe, introduced to the US in the 1800s as an ornamental. Vines are hairy, reaching 3-6.5 feet in length, with clear watery sap. Leaves are opposite, shiny dark green, oval, or heart-shaped, 2-5 inches long. Flowers are small, dark purple with triangular petals. Black swallowwort thrives in a wide variety of habitats, including roadsides, gardens, old fields, pastures, forests, and fens. Swallowworts form dense monocultures and contain compounds toxic to mammals, including livestock. They outcompete native plants, disrupting nesting by birds and lowering insect diversity and abundance. (MDNR 2012)

3.7.5.4 Invasive Terrestrial Animals

Emerald ash borer (Agrilus planipennis)

The emerald ash borer is native to Asia and is believed to have been brought to the United States in wood packing materials as early as the 1990s. The first beetle was discovered in the United States near Detroit, Michigan, in 2002. Since 2002, it has spread to 23 states and killed over 25 million ash trees. Much of the spread throughout the United States is from people moving firewood cut from infested trees. Adult emerald ash borers are a metallic emerald green and are approximately 7.5-15 mm long. The beetles will feed on leaves of the ash tree, but the main damage to the trees is the done by larvae feeding on the inner bark. All native ash trees in the United States have been found to be susceptible to emerald ash borer infestations. Adults are active from May to the beginning of September and are most active on sunny days when temperatures are above 77°F. Males live for an average of 7 weeks, while females live on average for 9 weeks. Females prefer to lay eggs on ash trees that are in open areas or on the edges of forests and will slowly move to more interior trees as the outer trees die from the infestation. Eggs are laid in cracks and crevices in the bark of the trunk, branches, and exposed roots. Once the larvae hatch after 7-10 days, they chew a path into the inner bark and outer sapwood. This is where tree nutrients are supported. Larvae will overwinter in the ash trees and emerge the following spring or early summer. They chew their way out and widen the tunnels they made moving to the interior of the tree. The adults emerge from a "D"-shaped hole, and once emerged they subsist on the ash leaves. Once trees become infested with emerald ash borers, they die within one to three years. (Chamorro et al. 2015; USDA 2020)

Hemlock wooly adelgid (HWA) (Adelges tsugae)

The hemlock wooly adelgid (*Adelges tsugae*) is a tiny (less than 1/16th inch in length) aphid-like insect native to hemlock forests in Asia and western North America. It was first discovered in eastern North America in the 1950s, likely introduced accidentally though trees imported from Japan. HWA can reproduce both sexually and asexually and produce two generations annually. In eastern North America, HWA exclusively reproduces asexually on hemlock. After hatching, HWA enters a mobile "crawler" nymph stage, moving to the base of a hemlock needle and inserting their needle-like stylet mouthparts. Mature nymphs have a white, wooly appearance. HWA feed on the nutrients stored in the needles for the remainder of their lives, causing tree mortality. HWA in North America is spread during the crawler phase by wind, wildlife, and human activity. (ODNR 2017)

Gypsy moth (Lymantria dispar)

The gypsy moth was introduced to the United States from western Europe in 1869. Adult male moths are a light brownish-yellow and are diurnal. Female moths are white with wavy black markings and cannot fly. Caterpillars are approximately 2 inches long with yellow and black heads. They are hairy and have five pairs of blue spots followed by six pairs of red spots on their back. Masses of 400-600 eggs are laid on various substrates such as trees and stones. The eggs overwinter and hatch in early spring. The larvae that hatch from the eggs can be dispersed by wind. Larvae will eat the leaves of trees all day and night until they are half grown, and they then become nocturnal. The preferred host trees for gypsy moths include alder, aspen, gray birch, white birch, hawthorn, larch, linden, mountain ash, oaks, willow, and witch-hazel. Tree mortality is often due to defoliation multiple years in a row. (Hoover 2022)

Feral pigs (Sus scrofa)

Feral pigs are a combination of Eurasian wild boar and escaped or un-kept domestic swine which were first introduced to the United States in 1539. In Ohio, adults range in size from 125-200 pounds. Larger individuals do occur, but in Ohio they rarely exceed 350 pounds. Feral swine are often referred to as "living rototillers" due to their destructive digging in search of roots, larva, tubers, eggs, and invertebrates. Rooting can range from a depth of 2 inches to 2 feet (sometimes as deep as 3 feet), causing significant damage to plants and soil integrity. Feral swine cause significant damage to agricultural crops and property, as well as natural resources each year. Ecological and economic losses from feral swine damage in the U.S are estimated to be $1.5 billion annually, when combined with control costs. (ODNR 2022d)

3.7.6 Procedures and Protocols

PNPP relies on administrative controls and other regulatory programs to ensure habitats and wildlife are protected as a result of a change in plant operations (i.e., water withdrawal increase, new NPDES discharge point, wastewater discharge increase, air emissions increase), or prior to ground-disturbing activities. The administrative controls, as discussed in Section 9.5, involve reviewing the change, identifying effects, if any, on the environmental resource area (i.e., habitat and wildlife), establishing BMPs, modifying existing permits, or acquiring new permits as needed to minimize impacts. Existing regulatory programs that the site is subject to, as presented in Chapter 9, also ensure that habitats and wildlife are protected. These are related to programs such as the following: stormwater management for controlling the runoff of pollution sources such as sediment, metals, or chemicals; spill prevention to ensure that BMPs and structural controls are in place to minimize the potential for a chemical release to the environment; bird nest removal; and management of herbicide applications to ensure that the intended use will not adversely affect the environment.

3.7.7 Studies and Monitoring

Energy Harbor maintains an Environmental Protection Plan to provide guidance for protection of non-radiological environmental values during operation of the nuclear facility. This plan includes, but not limited to reporting significant bird impaction events, onsite plant or animal disease outbreaks, mortality or unusual occurrence of any species protected by the Federal Endangered Species Act or USFWS, significant fish kills and increase in nuisance organisms or conditions.

3.7.7.1 Mussel Monitoring

Energy Harbor conducts periodic surveys to monitor mussel settlement in plant systems during spawning season in Lake Erie. The monitoring is performed by visual inspection of monitoring equipment and documented. A representative sample of a mussel, clam, or shell debris, if discovered, is submitted to the Chemistry Specialist for review.

3.7.7.2 Avian and Bat Monitoring

There are no site-specific avian or bat protection plans or mitigation measures in place for PNPP; however, Energy Harbor implements a Corrective Action Program in which Condition Reports are generated for incidents of bird mortality and nesting within the PNPP site. Following the discovery of a dead or nesting bird, Energy Harbor's corporate environmental avian subject matter expert is notified for identification and handling. The ODNR is then notified for recommendation for further action if the species is state and/or federally listed. Removal of a nest from plant structures follow procedures outlined in the plant administrative procedures.

Between 2017-2021 there were seven condition reports relating to bird mortality and nesting. The federally threatened yellow-billed cuckoo was recorded on one occasion (May 22, 2017) at the PNPP site. The report concluded that the species is not listed as threatened or endangered in the state of Ohio and was therefore not reported to the ODNR. Additionally, an injured peregrine falcon was discovered at the PNPP on January 28, 2022 and brought to a rehab center located at the Lake Metroparks – Kirtland Penitentiary Glen Reservation. Approximately 60 skeletonized birds were discovered on the circulating water pump intake screen on September 17, 2021. The screens were previously vacuumed on September 9, 2021. The birds were small, and one bird was identified by a band on its legs as a racing pigeon. Energy Harbor's condition report noted that the occurrence was not normal; however, the facility has not been able to identify the cause of this occurrence.

Bald eagles have been observed at the PNPP site as recently as 2021, but no surveys have been conducted.

3.7.7.3 Vegetation and Wetland Monitoring

Annual vegetation and wetland monitoring is conducted at the PNPP following the completion of a stream relocation project in 2015. The relocation project was conducted to divert stream flow from the existing stream to a new stream channel that will contain water resulting from a probable maximum flood and prevent flooding of PNPP. The project resulted in 4.946 acres of wetland impact, 3,242 linear feet of stream impact, and 100 feet of impact to the Lake Erie shoreline. Vegetation and wetland monitoring is being conducted per the OEPA Monitoring Report Guidelines outline and the USACE Minimum Monitoring Requirements for Compensatory Mitigation Projects. The Year 6 monitoring of the Diversion Stream was conducted in June 2021. The flood prone area vegetation has fully achieved majority (greater than 80 percent) areal cover of native vegetation. The results of the monitoring indicate that wetland quality has increased since 2016. During the past six years of monitoring, BMPs for reducing invasive species (i.e., herbicide application or mowing) were utilized and as a result fewer invasive species were identified within the vegetation observation locations in 2021.

3.7.7.4 As-Needed Monitoring

Studies and monitoring at PNPP occur as needed to comply with federal, state, and local regulatory requirements, as directed by the agencies, generally prior to new projects. Any monitoring that occurs is consistent with agency policies and procedures and performed under the guidance of the agency under which coordination is occurring.

3.7.8 Threatened, Endangered, and Protected Species, Essential Fish Habitat, and Critical Habitat

The USFWS maintains current lists of threatened or endangered species on its Information for Planning and Consultation (IPaC) website (USFWS 2022b). The ODNR also maintains county lists of state protected plant and animal species on its website (ODNR 2016a; ODNR 2020). Species located onsite or potentially occurring within Lake County are listed as threatened or endangered by these agencies are described below and summarized in Table 3.7-4.

Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by Energy Harbor for the licensed life of the PNPP facility.

Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to any special status and protected species.

3.7.8.1 Federally Listed Species

A total of six species in Lake County are federally protected under the Endangered Species Act (ESA): northern long-eared bat (*Myotis septentrionalis*), Indiana bat (Myotis sodalist), piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), Eastern Massasauga rattlesnake (*Sistrurus catenatus*), and snuffbox mussel (*Epioblasma triquetra*). Additionally, the monarch butterfly (*Danaus plexippus*) is federally listed as a candidate species. Critical habitat for the piping plover is designated for Lake County. (USFWS 2022b).

3.7.8.1.1 Northern long-eared bat (Myotis septentrionalis)

The northern long-eared bat (*Myotis septentrionalis*) is federally listed as threatened. During the summer, northern long-eared bats use cavities under bark on both dead and live trees as well as mines and caves to roost. Females will roost in small colonies of 30-60 bats and on average give birth to one pup per female. During the winter, bats hibernate in small crevices and cracks in caves and mines that have constant temperatures, high humidity, and no air currents. Changes to any wintering site microclimates can make that habitat unsuitable for the bats. Threats to this species include white-nose syndrome, impacts to roost sites, loss of habitat, and wind farm operations. (USFWS 2015)

The current known range for the northern long-eared bat overlaps with the PNPP site (USFWS 2022a). Suitable roosting and maternity habitat for the northern long-eared bat is present on the PNPP site; however, ODNR Natural Heritage Inventory (NHI) data indicate no occurrences of northern long-eared bat documented within a 1-mile radius of the PNPP site.

3.7.8.1.2 Indiana bat (Myotis sodalis)

The Indiana bat (*Myotis sodalis*) is federally listed as endangered. The Indiana bat is a federally endangered species that hibernates in caves and mines in winter. The large winter colonies disperse in spring, and the bats migrate to summer habitats in wooded areas, where reproductive females form smaller maternity colonies. Males and non-reproductive females roost in trees but typically not in colonies. The range of the Indiana bat extends from the northeast through the east-central United States. The Indiana bat typically forages in semi-open forested habitats, forest edges, and riparian areas. Summer roosting habitat suitable for use by the Indiana bat requires dead, dying, or living trees of adequate size with sufficient exfoliating bark. Multiple roost sites may be used. Summer roosts typically are behind the bark of large, dead trees, particularly those that are in gaps in the forest canopy or along forest edges so that they receive sufficient sun exposure (USFWS 2004). Indiana bat populations are stable or decreasing throughout portions of its range due to loss of habitat and disease, in particular white-nose syndrome, a fungal disease that has caused substantial mortality in this species and other bat species (NS 2022b).

The current known range for the Indiana bat overlaps with the PNPP site (USFWS 2022a). Suitable roosting and maternity habitat for the species is present on the PNPP site; however, ODNR NHI data indicate no occurrences of Indiana bat documented within a 1-mile radius of the PNPP site.

3.7.8.1.3 Piping plover (Charadrius melodus)

Piping plovers (*Charadrius melodus*) are federally listed as endangered. Piping plovers are small shorebirds that are approximately 7 inches long and weigh between 43-63 grams. During the breeding season, adult birds are sandy gray above, with a white collar and underparts. They have a black band that stretches across the forehead between the eyes and a black band also develops around the neck. Legs are orange, and the bill is orange with a black tip. During the non-breeding season, the feathers on the back are paler and the black bands on the forehead and neck are not present. The bill becomes all black. Piping plovers breed from the northern Great Plains through North Dakota and South Dakota and southward along major rivers to northern Kansas. They can be found breeding on the beaches of Lake Superior, Lake Michigan, and Lake Huron in Michigan and Wisconsin. The Atlantic population breeds along the coast of New England from Novia Scotia through the mid-Atlantic coast down to North Carolina. Little is known about their overwintering territory. The population of piping plovers that breeds in the Great Plains region spends the winter along the Gulf Coast, while the population that breeds along the Atlantic coast spends the winters further down the Atlantic coast near Florida. They are also thought to overwinter in Mexico, the Bahamas, and Cuba. Fall migration peaks between August and September but can occur from July through November. Spring migration peaks by mid-April and most birds have left overwintering sites by mid-May. (Elliott-Smith and Haig 2004)

Breeding begins in late April to early May and pairs typically raise only one brood per year. Nests are constructed in sand, shells, or gravel-covered ground near patches of grass, away from water, and near a large object such as a log. Nests are shallow depressions scratched into the ground 1-2 cm deep that may or may not be lined with pebbles or shells. Females typically lay four eggs, which are incubated for approximately 20-30 days by both the males and females. Both parents also brood the young birds after hatching. Chicks forage near their parents and remain with family groups through fledging, which can occur between 21-35 days after hatching. Piping plovers prefer wide and sparsely vegetated beaches and have been documented breeding on alkali lakes, barrier islands, reservoirs, rivers, and on sand bars. Similar habitat on beaches, mudflats, and sandflats along the Gulf of Mexico and Atlantic coasts are preferred during the winter months. Threats to this species include habitat degradation and loss, particularly from development and beach stabilization projects. (Elliott-Smith and Haig 2004)

The PNPP site overlaps with the designated critical habitat for the piping plover (USFWS 2022b); however, no records of this species have been documented within one mile of the PNPP site.

3.7.8.1.4 Red knot (Calidris canutus)

The red knot (Calidris canutus) is listed as federally endangered. The red knot migrates annually between its breeding grounds in the Canadian Arctic to overwintering regions, which range from the southeastern United States, the northwest Gulf of Mexico, northern Brazil, to Tierra del Fuego at the southern tip of South America. During both the northbound (spring) and southbound (fall) migrations, groups of a few individuals to thousands of red knots can be found anywhere along the coastal and inland United States migration corridors from Argentina to Canada. In the spring, well-known staging and stopover areas include Patagonia, Argentina; eastern and northern Brazil; the southeastern United States; the Virginia barrier islands; and Delaware Bay. In the fall, well-known migration stopovers include Hudson Bay, James Bay, St. Lawrence River, Mingan Archipelago, and the Bay of Fundy in Canada; the Massachusetts and New Jersey coasts; the Altamaha River in Georgia; the Caribbean; and the northern coast of South America from Brazil to Guyana. Throughout the range, red knots occur primarily along the coasts, but also migrate across areas of open ocean as well as over land. (USFWS 2014)

In the United States, red knots use both coastal and interior routes during migration, including the central, Mississippi, and Atlantic flyways. Most records in the interior states show small numbers, fewer than 100 red knots, but there are multiple records in every inland state. Although several thousand red knots migrate through inland areas each year, scientists are just beginning to discover where these birds are stopping to rest and feed along the way. For example, geolocator information shows red knots using stopovers in North Dakota and in Montana, and there are clusters of sighting records along tributaries to the Mississippi River and along the Great Lakes. (USFWS 2014)

Threats to food resources from climate change and other causes occur throughout the red knot's range. Data suggest reduced horseshoe crab populations in Delaware Bay due to commercial harvesting is an important factor in red knot population declines. The birds rely on horseshoe crab eggs as a major source of nutrition during migration. Since 2000, the Atlantic States Marine Fisheries Commission has restricted harvest of horseshoe crabs, and in 2012 it implemented an adaptive management framework that explicitly ties crab harvest levels to red knot populations. Though crab numbers have not completely rebounded, the full implementation and monitoring of this framework should lead to increased crab populations and help red knot recovery. Outside Delaware Bay, the red knot feeds mainly on small clams and mussels, except in its arctic breeding grounds, where it feeds mainly on insects. Climate change has begun affecting both types of prey. Oceans are more acidic as CO_2 emitted into the atmosphere dissolves in the ocean; this interferes with the ability of clams and mussels to form shells. Clams and mussels are also sensitive to warming water temperatures, and changes in their geographic distribution or timing of spawning are likely to affect red knot food supplies during important stopover periods. For example, the range of blue mussels, the young of which are an important prey species for red knots, has already shrunk due to warming ocean temperatures and the mussel may soon be unavailable as a resource for migrating red knots. On the arctic breeding grounds, insects are hatching earlier in the spring due to warming temperatures. This change in timing could cause red knot chicks to miss the peak window for feeding and rapid growth before their long southward migration. Additionally, sand placement projects and off-road vehicle use are known to bury or crush animals that the red knots eat. (USFWS 2014)

The current known range of the red knot overlaps with the PNPP site (USFWS 2022b); however, no records of this species have been documented within one mile of the PNPP site.

3.7.8.1.5 Eastern Massasauga rattlesnake (Myotis sodalis)

The Eastern Massasauga rattlesnake (*Myotis sodalis*) is federally listed as threatened. Massasaugas are small snakes with thick bodies, heart-shaped heads, and vertical pupils. The average length of an adult is about 2 feet. Adult massasaugas are gray or light brown with large, light-edged chocolate brown blotches on the back and smaller blotches on the sides. The snake's belly is marbled dark gray or black and there is a narrow, white stripe on its head. Its tail has several dark brown rings and is tipped by gray-yellow horny rattles. Young snakes have the same markings but are more vividly colored. The head is a triangular shape, and the pupils are vertical.

Massasauga require "early-successional" habitat which includes a variety of herbaceous-dominated habitats: prairies, grasslands, savannas, meadows, and fallow fields. Massasaugas also use adjacent uplands (shrubland, open woodlands, prairie) during part of the year. The presence of wetlands within or adjacent to these habitats is required, as the species typically overwinters in burrows (usually those made by crayfish) that allow access to groundwater. These wetlands include wet prairies, sedge meadows, bogs, fens, and swamp forests. They may also be found under logs and tree roots or in small mammal burrows. Disturbance is necessary to maintain the open-canopy habitat required by the Massasauga. Historically, this disturbance likely came from flooding (including that caused by beaver impoundments), storms, and wildfires. (ODNR 2021b; USFWS 2022c)

The current range of the eastern Massasauga rattlesnake overlaps with the PNPP site (USFWS 2022c). Suitable habitat for the species is likely present in portions of the PNPP site as well as in the vicinity; however, no records of this species have been documented within one mile of the PNPP site.

3.7.8.1.6 Snuffbox mussel (Epioblasma triquetra)

The Snuffbox mussel (*Epioblasma triquetra*) is federally endangered. The snuffbox is a small- to medium-sized mussel, with males reaching up to 2.8 inches. The maximum length of females is about 1.8 inches. The shape of the shell is somewhat triangular (females), oblong, or ovate (males), with the valves solid, thick, and very inflated (USFWS 2022d). The species historical range included Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin. Mussels are long-lived animals. Members of many species may live for several decades and in some instances, a century or more. They spend most of their lives buried in the bottom sediments of permanent water bodies, and often live in multi-species communities called mussel beds. These mussels are primarily sedentary, but they can move around with the use of their foot, which is a hatchet shaped muscle that can be extended out between the valves (shells). A mussel will burrow its foot into the sediment and then contract it to pull itself slowly along the bottom of its aquatic habitat (MNDNR 2022b).

According to USFWS IPaC data, the snuffbox mussel is considered unlikely to occur within 6 miles of the PNPP site (USFWS 2022d). There has been no recent observation of the mussel species snuffbox in the vicinity of the PNPP, or any other state or federally listed aquatic species in the vicinity of the PNPP site.

3.7.8.1.7 Monarch butterfly (Danaus plexippus)

The Monarch butterfly (*Danaus plexippus*) is one of North America's most iconic insects. It's seen in backyards gardens and in highly urbanized locales. Monarchs live in fields and parks where milkweed and native plants are common. (ODNR 2015)

Monarch butterflies migrate annually over long distances to overwinter as adults at forested locations in Mexico and California. The North American migratory populations account for more than 90 percent of the worldwide number of monarch butterflies. Overwintering sites provide protection from the elements (for example, rain, wind, hail, and excessive radiation) and moderate temperatures, as well as nectar and clean water sources. (USFWS 2020)

Adult monarch butterflies feed on nectar from a wide variety of flowers. Reproduction is dependent on the presence of milkweed, the sole food source for larvae. The primary threats to the monarch's biological status include loss and degradation of habitat from conversion of grasslands to agriculture, widespread use of herbicides, logging and thinning at overwintering sites in Mexico, senescence, and incompatible management of overwintering sites in California, urban development, drought, exposure to insecticides, and the effects of climate change. (USFWS 2020)

In December 2020, the USFWS found that listing the monarch butterfly as an endangered or threatened species is warranted but precluded by higher priority actions to amend the lists of endangered and threatened wildlife and plants. When a petitioned action is found to be warranted but precluded, the USFWS is required by the ESA to treat the petition as resubmitted on an annual basis until a proposal or withdrawal is published. Thus, the monarch butterfly is currently listed as a candidate species for protection under the ESA. (USFWS 2020)

Suitable habitat for the monarch butterfly is likely present in undeveloped portions of the PNPP site that are not maintained by mowing. Additionally, suitable habitat is present in the vicinity of the PNPP site. However, ODNR data show no recorded occurrences of the monarch butterflies within a 1-mile radius of the PNPP site.

3.7.8.2 State-Listed Species

A total of 30 animal and 33 plant state-listed species are listed as potentially occurring in Lake County. Of these, four plant (Threehorn warty back, fawnsfoot, American beach grass, and inland beach pea) and one animal (spotted turtle) species have been recorded within a 1-mile radius of the PNPP site.

3.7.8.2.1 Upland sandpiper (Bartramia longicauda)

Upland sandpiper is state listed as endangered. The bird a medium-sized shorebird of about 28-32 cm in length. Some distinguishing features of the Upland Sandpiper include its dove-like head, thin neck, long thin legs, camouflage olive-brown coloring, and yellow bill with a black tip. The under parts of the Upland Sandpiper are whitish or yellowish in color. The sides and breast of the Upland Sandpiper are strongly patterned with dark and pale brown buff. The call of the Upland Sandpiper is a distinctive, long "wolf whistle." Juveniles appear similar to adults with a paler head. The Upland Sandpiper is a fully terrestrial shorebird that is rarely found in wetland or coastal areas, which makes it unique from other shorebirds. Instead, its preferred habitat is grasslands. Seventy percent of the breeding population of Upland Sandpipers occurs in grassland areas of the central and northern Great Plains. (USFWS 2022e)

3.7.8.2.2 Lark sparrow (Chondestes grammacus)

Lark sparrow is state listed as endangered. The bird is a pale New World sparrow with a bold, complex head pattern of a chestnut crown and cheek patches, a pale stripe over the eye, and a strong black malar stripe. Males sing a melodious jumble of churrs, buzzes, and trills. Lark sparrows occur in prairies, grasslands, and pastures with scattered shrubs, singing from conspicuous perches like wires and fence posts. They forage on the ground, feeding on insects and seeds. Lark sparrows build nests of grass and twigs the ground, and in trees and shrubs, and sometimes reuse old nests of other species. Eggs are creamy white with dark spots, 0.7-0.9 inches, laid in clutches of three to six. Populations declines are attributed to habitat loss. (CU 2019a)

3.7.8.2.3 Northern harrier (Circus hudsonius)

The northern harrier is state listed as endangered. The bird a medium-sized raptor with an owl-like face and a white rump patch. Males are gray and white; females are larger and streaked brown. The northern harrier soars slowly and low over grasslands, marshes, and fields, holding their wings in a V-shaped "dihedral" posture. They feed on small mammals, reptiles, amphibians, and birds. Nests are built on the ground in dense vegetation, made from thick-stalked plants. Eggs are dull white, 1.3-1.6 inches, laid in clutches of four to five. (CU 2019b)

3.7.8.2.4 Least bittern (Ixobrychus exilis)

The least bittern is state listed as threatened. The bird is a small, secretive heron with a long pointed yellow bill. Males have a dark green crown and back, females have a dark brown crown and back. The neck is striped chestnut and white. Least Bitterns fly with their neck tucked in and their legs trailing. They nest in freshwater and brackish marshes with tall aquatic vegetation such as cattail and rushes. They winter in wetland in the southern US, Mexico, the Caribbean, and Central America. Least Bitterns feed on small fish, reptiles, amphibians, crustaceans, mice, leeches, and dragonflies. Nests are built in reeds over water. Eggs are pale blue or green, 1.2-1.3 inches, and laid in clutches of two to six eggs. The species is threatened by loss of wetland habitat. (CU 2019c)

3.7.8.2.5 Black-crowned night-heron (Nycticorax nycticorax)

The black-crowned night-heron is state listed as threatened. This species is a stocky, thick-billed, and short-legged bird. The adult can be identified by its blackish back and black cap and pale gray underparts. Eyes are red, and the legs are yellow or yellow green. During the breeding season, they develop two long, white head plumes and their legs turn pink. Black-crowned night-herons frequently breed in mixed colonies with other herons. Nest construction begins usually during April or May. Incubation of the three to five eggs lasts 24-36 days. Most young hatch during May, while the last nesting attempts may not produce young until the first half of June. Young fledge 6-7 weeks after hatching. These herons are often found roosting in thick vegetation along streams, lakes, and wetlands. They typically eat fish, leeches, earthworms, and aquatic and terrestrial insects. (ODNR 2022e)

3.7.8.2.6 Chimarra socia and Psilotreta indecisa

Caddisflies are mothlike insects, about 1.5 inches, with long, threadlike antennae. The *Chimarra socia* and *Psilotreta indecisa* are listed as endangered and threatened, respectively at the state level. Larvae are aquatic, 0.5-1.5 inches, and build a portable protective case around their bodies made from tiny pieces of plants, sand grains, and other detritus. Adults roost in plants during the day and fly at night. Larvae creep along the bottoms of streams, rivers, lakes, ponds, and marshes. Larvae feed on miscellaneous organic detritus, adults eat flower nectar, or not at all during their brief lives. Caddisflies are eaten by fish, birds, and reptiles. They are sensitive to pollution and thus serve as an indicator of water quality. (MDC 2022)

3.7.8.2.7 Lilypad Forktail (Ischnura kellicotti)

The lilypad forktail is a damselfly ranging from 24-31 mm in length. It is endangered at the state level. Males have yellow wings; females have blue and red forms. The thorax is bright blue with wide black stripes on the rear shoulder, the abdomen is spotted with blight blue segments. They are associated with lilypads, and females are speculated to insert their eggs into a lily stem, and, upon hatching, the nymphs remain clinging to the submerged lily surfaces. (Moody 1993)

3.7.8.2.8 Boreal bluet (Enallagma boreale)

The boreal bluet is state listed as threatened. It is a damselfly found throughout the northern United States and Canada. Their bodies are 1.1-1.5 inches in length. Males are blue, females are blue green. It is usually found at still waters, including ponds and boggy lakes. In some places, it also can be found at slow streams. (Lung and Sommer 2001a)

3.7.8.2.9 Northern Bluet (Enallagma cyathigerum)

The northern bluet is state listed as threatened. It is a small damselfly found in northern latitudes. Adult body is 1 to 1.5 inches long. The males are predominately blue on the sides of the thorax, and the upper side of the abdomen. The lower abdominal appendages are longer than the upper appendages. Females are greenish yellow to brown. The upper side of the abdomen is mostly black. It occurs at lakes, ponds, and marshes, and streams with slow to moderate flow. It occurs in a wide variety of habitats, from sagebrush desert to mountain lakes. Adults eat a wide variety of small soft-bodied flying insects, such as mosquitoes, mayflies, flies, and small moths. They will also pick small insects such as aphids from plants. (Lung and Sommer 2001b)

3.7.8.2.10 Marsh Bluet (Enallagma erbium)

The marsh bluet is a small damselfly about 1 to 1.25 inches long. It is listed as threatened at the state level. The males are predominately blue on the sides of the thorax, and the upper side of the abdomen. Both the upper and lower anal appendages are about the same length. Females are greenish yellow to brown. The upper side of the abdomen is mostly black. The marsh bluet occurs at lowland lakes, ponds, and marshes, and has a definite preference for alkaline waters. (Lung and Sommer 2001c)

3.7.8.2.11 Racket-tailed emerald (Dorocordulia libera)

The racket-tailed emerald is a slender and fragile-looking dragonfly. It is listed as threatened at the state level. The length of the body averages about 1.1 inches. They have a metallic green thorax with brown hairs, black legs, and clear wings. The eyes are metallic green, seemly luminous. The abdomen is thinly haired bronze and green. Its black abdomen is almost shaped like a spatula with a narrow tip. It is commonly found throughout northeastern United States and southeastern Canada. It prefers ponds, lake coves, bogs, and bog-edged slow streams. (WDNR 2022a)

3.7.8.2.12 Uhler's sundragon (Helocordulia uhleri)

Uhler's sundragon is a medium–sized dragonfly. The species is endangered at the state level. Adults of this species have a characteristic gold spot near the center of the brown basal spot. Adults are fast fliers but can be frequently observed hovering and sometimes basking on rocks. This species can be found in clean rivers and streams with abundant forest cover and a circumneutral pH. Adults can be found in clearings, perching on brush and weeds, and sometimes on the ground. Larvae can be found along shallow stream margins in organic matter depositions. Widespread across the eastern Appalachians. It is known from all northeastern states, all Mid-Atlantic states (except Delaware), and all southeastern states except Mississippi and Florida. *H. uhleri* is also known from Arkansas and Missouri. In Canada, it can be found from Nova Scotia west to Ontario. (NCP 2022)

3.7.8.2.13 Green-faced clubtail (Gomphus viridifrons)

The green-faced clubtail is listed as threatened at the state level. It is a small clubtail dragonfly with a mostly black abdomen except for small yellow triangles on the dorsal base of each segment and a larger yellow marking on the side of segment eight. There is a single black line across the face. Eyes are green. The size is 45-46 mm (1.8 inches). It prefers larger rivers with rocks and moderate current. (VCDR 2022)

3.7.8.2.14 Riffle snaketail (Ophiogomphus carolus)

The riffle snaketail is listed as threatened at the state level. It is a dragonfly found throughout northeastern United States and southeastern Canada. The male has a greenish thorax with black shoulder and thoracic stripes. The length of the body varies from 1.6-1.8 inches. The female is similar to male, but with paler coloration. The legs are usually black, in some cases thighs can have pale green stripes. The abdomen is usually black with pale green markings with dorsal stripes and some spots at the end of the abdomen. The eyes can vary from green to pale blue. It prefers woodland streams and rivers that are clear, fast-moving, and with sand or rocks. (WDNR 2022b)

3.7.8.2.15 Lake sturgeon (Acipenser fulvescens)

The lake sturgeon is endangered at the state-level. It is a bottom-dwelling fish characterized by a robust, torpedo-shaped body covered by five rows of bony plates, or scutes. Average individuals are from 20-55 inches long and weigh 2-60 pounds, and some can reach 8 feet long and 300 pounds. They are opportunistic bottom feeders that forage over gravel, sand and/or mud substrates where they use their protrusible mouths to extract prey items, such as snails, clams, crustaceans, fish, and aquatic insect larvae. They occur in rivers and shallow areas of lakes and spawn in gravelly tributary streams of rivers and lakes. Risks to the species include physical barriers to spawning, loss of habitat, declining water quality, sea lamprey parasitism, zebra mussel colonization of spawning habitats, and predation of eggs by round gobies. (Goforth 2000)

3.7.8.2.16 Cisco (Coregonus artedi)

The cisco, or lake herring, is endangered at the state-level. It is a cold-water schooling fish native to the northern United States and Canada. The majority of the population is found in small inland lakes and the Great Lakes. Their morphology, pigmentation, and behavior vary widely throughout their range. Adult cisco weigh between 0.5-4 pounds. They primarily feed on plankton. They spawn in November and December, in gravel, rubble, rocks, and sand. During the 1800's and early 1900's Cisco populations supported large commercial fisheries in all five Great Lakes. These commercial fisheries collapsed by the mid 1900's following decades of overfishing, habitat degradation, and impacts from invasive species such as Rainbow Smelt and Alewife. (George 2019)

3.7.8.2.17 Iowa darter (Etheostoma exile)

The Iowa darter is endangered at the state-level. It is a small, bottom-dwelling member of the perch family. Their bodies are elongated, average 1.4-3 inches in length, their snouts are rounded. Males are light brown dorsally to light olive brown or yellow on the belly, Females are larger with more mottled coloration. Iowa darters are found in low gradient creeks, in the pools of moderate size rivers, in deep and shallow lakes and in herbaceous wetlands. They overwinter in pools, and spawn in vegetated shallows from March-June. Their decline in Ohio is attributed to agricultural land-use practices, nearby urban development, and exotic species. (Bland and Willink 2018)

3.7.8.2.18 Northern brook lamprey (Ichthyomyzon fossor)

The northern brook lamprey is endangered at the state-level. It is a non-parasitic lamprey reaching up to 6.3 inches in length. Adults are grayish brown dorsally, with a pale median line down the back, and lighter ventrally. The posterior portion of the tail is darker, almost black. Females tend to be slightly larger. The majority of its life, three to six years, is spent as a blind ammocoete, partially buried in sandy substrate. Ammocoetes feed on drifting, suspended, organic detritus, algae, and bacteria, or nutrients drawn from the surrounding sediment. Transformation to adults occurs over 2-3 months in late summer or early fall. As adults, they do not feed, living instead off body fat reserves. Adults are typically found over coarse substrate, sand, or gravel; in swifter waters, riffles, or runs. Ammocoetes are found burrowed in fine sediment or organic debris, inside channels or other quiet water in areas with embedded woody debris. Spawning occurs in crevices beneath rocks and boulders. Decline is attributed to habitat degradation and incidental poisoning. (MNDNR 2022c)

3.7.8.2.19 Shortnose gar (Lepisosteus platostomus)

Shortnose gar is a long, slender fish that is endangered at the state-level. It is brown or olive green along its back, yellowish along the sides, with a whitish belly. This species prefers slow silty or clear-water rivers, wave-washed shoals of large lakes, quiet creek pools and river backwaters. It is usually found at the water surface, often near vegetation and submerged logs. Larvae attach to vegetation or debris, and adult fish spawn in shallow grassy sloughs. They feed on fish, crayfish, and insects. Young gar are known to feed on small insects and zooplankton. Gar are known as fierce predators of smaller fish, using ambush as a primary hunting technique. (Fuller et al 2019a)

3.7.8.2.20 Pugnose minnow (Opsopoeodus emiliae)

The pugnose minnow is endangered at the state-level. It is a small silver minnow averaging around 2 inches in length. It has a distinct black lateral band running from the tail through the eye to the upturned mouth. The pugnose minnow occurs in rivers and shallow regions of lakes, preferring slow, clear water over sand or organic substrate, and is found in greatest abundance in weedy areas. They feed on a variety of aquatic invertebrates, including midge and black fly larvae, and microcrustaceans. They also feed on algae. The pugnose minnow is found from the southern Great Lakes basin and upper Mississippi River valley to the Gulf of Mexico. At the northern edge of its range, it is becoming rare, imperiled by increased siltation and loss of weedy habitats. (Carman 2001)

3.7.8.2.21 American eel (Anguilla rostrata)

The American eel is threatened at the state-level. It is a fish with slender snakelike body with very small scales. A long dorsal fin usually extends for more than half the length of the body and is continuous with a similar ventral fin. Pelvic fins are absent. The back may be olive-green to brown, shading to greenish yellow on the sides and light gray or white on the belly. Adults spend most of their lives in freshwater, and move to and spawn in the Sargasso Sea, a tropical area northeast of Cuba. Growing eels migrate inland. American eels are nocturnal carnivores, feeding on insects, fish, fish eggs, crabs, worms, clams, frogs, and dead animal matter at night and taking shelter during the daylight hours. Adults live in streams with continuous flow or in muddy, silt bottomed lakes. (Fuller et al 2019b)

3.7.8.2.22 Black bear (Ursus americanus)

The American black bear inhabits Canada, the United States, and Mexico. The bear is endangered at the state-level. They are generally solitary, and inhabit a wide range of habitats, including high-elevation and low-elevation coniferous and deciduous forests, pinyon-juniper woodlands, chaparral, desert grasslands, desert scrub, and swamps. They are omnivorous and opportunistic eaters, feeding on young green vegetation, insects, fruits, nuts, seeds, carrion, caribou, elk, deer, squirrels, bird eggs, and salmon. Human-related mortality for American black bears is caused by hunting, collisions with vehicles, and poaching. American black bears have been eliminated from much of their range by the livestock industry. (Ulev 2007)

3.7.8.2.23 Midge (Rheopelopia acra)

R. acra is a non-biting midge with no common name. This species is endangered at the state-level. They are found in running water. The taxonomy of larval *R. acra* is poorly understood, and *R. acra* is known only from adult specimens. Midges in the genus *Rheopelopia* are distinguished by the lack of dorsomental teeth; 2 or 3 segmented b sensillum; maxillary palp with ring organ in distal third; basal portion of maxillary palp usually shorter than antennal segment 2; mandible with an extremely reduced basal tooth and apparently absent accessory tooth; and the long, thick, radially arranged body setae. (Epler 2001)

3.7.8.2.24 Eastern pondmussel (Ligumia nasuta)

The eastern pondmussel is endangered at the state-level. It is a small, elliptical mussel reaching a length of 10 inches. The color can be olive green, to brown or blackish. The posterior end of the shell is usually pointed in males and rounded in some females, and moderately compressed. It prefers still water of good quality, lakes, ponds, or backwaters of rivers, in mud or sand. Although once common in Lake Erie, the last viable population known in northeastern Ohio is in the Upper Cuyahoga River. (Krebs 2015)

3.7.8.2.25 Black sandshell (Ligumia recta)

The black sandshell is threatened at the state-level. It is an elongate, moderately thick mussel reaching up to 8 inches long. The shell is smooth, shiny, greenish, or black, and often rayed. Females have a more truncated posterior, while males have a more pointed posterior. The black sandshell is usually found in the riffle and run areas of medium to large rivers in areas dominated by sand or gravel. They are threatened by degradation of habitat through siltation, damming, and pollution. Zebra mussels can attach themselves in large numbers to the shells of native mussels, eventually causing death by suffocation. (MNDNR 2022d)

3.7.8.2.26 Threehorn Wartyback (Obliquaria reflexa)

Threehorn wartyback is threatened at the state-level. It is a medium-sized freshwater mussel generally reaching 40 mm in adult length. The shell is thick, circular to triangular in shape, rounded on the anterior end and bluntly pointed on the posterior, with two to five large knobs or "horns." The shell can be green, tan, or brown with or without rays. Threehorn wartyback are typically found in large rivers with moderate current and stable substrate of gravel, sand, and mud. Populations in Lake St. Clair, Lake Erie, and the Detroit River appear to have been lost. Threats include pollution, invasive species including zebra and quagga mussels, and round gobies, recreational activities, and spills. (COSEWIC 2013)

Threehorn wartyback has been recorded within a 1-mile radius of the PNPP site.

3.7.8.2.27 Fawnsfoot (Truncilla donaciformis)

The fawnsfoot is threatened at the state-level. It is a small species of mussel with a stout, elliptical, moderately inflated shell up to 2 inches long. Males usually have a more sharply pointed posterior, whereas females have a more rounded or angled ventral margin. The outside surface of the shell is smooth and brown, yellowish, or greenish in color, and has V-shaped or zigzag markings with overlaying green rays. Fawnsfoot occur in lakes and rivers, in soft or coarse substrate, and they have been found at depths up to 30 feet. Threats to the fawnsfoot include loss and degradation of habitat, including dams that limit host fish movements and fragment rivers, non-point and point source pollution, siltation, and infestation of non-native zebra mussels. (Seitman 2018)

The occurrence of fawnsfoot has been recorded within a 1-mile radius of the PNPP site.

3.7.8.2.28 Spotted turtle (Clemmys guttata)

The spotted turtle is threatened at the state-level. It is a small turtle species, averaging 4.5 inches in length. The carapace is smooth, and black, or brownish black with a variable number of round yellow spots. The plastron is yellow or orange with black blotches. Spotted turtles prefer shallow waters with a soft bottom substrate and some submergent and emergent vegetation, including sedge meadows, boggy ponds, fens, tamarack swamps, sphagnum seepages, and slow, muddy streams. Spotted turtles eat algae, leaves of soft aquatic plants, water lily seeds, worms, mollusks, crustaceans, adult and larval insects, amphibian eggs and larvae, and carrion. Spotted turtles are threatened by loss and isolation of wetland habitats, predators, and the pet trade. (Harding 2013)

There is a record of the spotted turtle within a 1-mile radius of the PNPP site.

3.7.8.2.29 Short-fringed Sedge Carex crinita var. brevicrinis

Short-fringed sedge, or short-hair sedge (*Carex crinita* var. *brevicrinis*) is a tufted, grass-like plant that grows up to 5 feet tall. Stems are rough and three-sided, particularly near the base. Leaves are alternate and linear, flowers are cylindrical spikes at the tops of stems, with male spikes held above drooping female spikes. Short-fringed sedge grows in wetland and moist to wet woodlands. It is threatened by habitat loss and fragmentation, land conversion for development, and displacement by invasive species. (PNHP 2019)

3.7.8.2.30 Rock-harlequin (Corydalis sempervirens)

Rock harlequin is a native, biennial, or annual forb that grows 8-51 inches tall. Flowers are drooping and tubular, pink with yellow tips. The leaves have three to five primary segments that are 7-20 mm long and 3-6 mm wide. The fruit is an erect, elongated, dry, dehiscent capsule from 0.8 to 2 inches long. Each fruit contains about 25 seeds. Rock harlequin is a pioneer species in secondary succession, particularly after fires. It grows best in full light and is found in a variety of woodland communities. (Meyer 2013)

3.7.8.2.31 Canada Hawkweed (Hieracium umbellatum)

Canada hawkweed is a perennial forb with stems reaching up to 5 feet tall. Flowers occur in branched clusters of heads with yellow petals, about 1 inch wide. Leaves are alternate and lanceolate with rounded bases and toothed margins. Canada hawkweed occurs on disturbed sites like fields and roadsides, and rocky slopes, opening in forests, prairies, and thickets. (Strother 2022)

3.7.8.2.32 Few-flowered St. John's-wort (Hypericum ellipticum)

Few-flowered, or pale, St. John's-wort is an erect perennial forb found in stream, lake, and pond margins, wet meadows, and swamps. Leaves are simple, alternate, 0.5-1.25 inches long, stalkless, and rounded at the tip. Flowers are 0.5 inches across, five petaled, pale yellow, and sometimes tinged red. Fruit is an oval capsule. (Robson 2022)

3.7.8.2.33 Alpine Rush (Juncus alpinoarticulatus)

Alpine rush is an erect or slightly decumbent grasslike perennial herb reaching a height of 20 inches. Like other rush species, its flowers are small with inconspicuous petals. It occurs in wet, open to semi-open habitats, in sandy, usually calcareous soil, on shores of lakes and ponds, marshes, ditches, wet meadows, and wet areas of abandoned limestone quarries. Threats to this species include drainage or other alteration of the wetland habitat and overshading by woody species as a result of succession. (ODNR 2022f)

3.7.8.2.34 Inland Beach Pea (Lathyrus japonicus)

Beach pea, or sand pea, is a perennial trailing vine with a stout, angled stem, dark green oval leaves, and pink-lavender pea-like flowers in long-stalked clusters. It is found in beaches and gravelly areas. Peas and very young pods are edible; however, seeds are toxic, causing paralysis, slow and weak pulse, shallow breathing, convulsions if eaten in large quantities. (UTA 2015a)

Inland beach pea has been recorded within a 1-mile radius of the PNPP site.

3.7.8.2.35 Yellow Vetchling (Lathyrus ochroleucus)

Yellow vetchling, or cream pea, is a perennial herb that grows up to 40 inches in height. Leaves are alternate and pinnately divided into three to five pairs of oval leaflets. Flowers are racemes of five to 10 yellowish-white flowers with five petals. Fruit is flat, legume, 4-5 cm long. Roots contain nodules of nitrogen-fixing bacteria. It grows best in dry rocky woodlands, brushy ravines, stream valleys, and roadsides, preferring sunny-edged or slightly shaded areas. (Friedman 2013)

3.7.8.2.36 Dwarf Bulrush (Lipocarpha micrantha)

Dwarf bulrush is a small annual graminoid, about 2-6 inches tall. Leaves are narrow and drooping. Flowers are small yellowish to reddish brown spikelets about 1 mm long. It is found on sandy borders of ponds and streams. Dwarf bulrush is threatened by heavy recreational use of the sandy habitats where it occurs. (MDACF 2022a)

3.7.8.2.37 Flat-stemmed Pondweed (Potamogeton zosteriformis)

Flat-stemmed pondweed is a submerged plant with a very flat stem and linear leaves 4-8 inches long. Flowers are a cylindrical spike held above the surface of the water. Fruit is a light green to olive oval achene. Flat-stemmed pondweed may also spread vegetatively through budding. It is found in waters 20+ feet deep, usually with a sandy or mucky bottom, less commonly in silt and gravel. (MW 2022a)

3.7.8.2.38 Bushy Cinquefoil (Potentilla paradoxa)

Bushy cinquefoil, or paradox cinquefoil, is a biennial or short-lived wetland perennial reaching 29 inches in height. Leaves are pinnate with oblong leaflets. The upper plant is strongly hirsute. Flowers are yellow. It grows in sandy streambanks, lake shores, and moist flats. (Aitken and Parks 2004)

3.7.8.2.39 Early Buttercup (Ranunculus fascicularis)

Early buttercup, or early crowfoot, is a flowering perennial that grows up to 1 foot in height from a basal rosette. Leaves are pinnately compound with narrow, blunt lobes. Flowers are yellow and bloom earliest among the buttercups. Early buttercup grows in thin soil in open woods or exposed hills and ledges. Populations are vulnerable to conversion of their habitat to residential or other use. (MDACF 2022b)

3.7.8.2.40 Leafy Goldenrod (Solidago squarrosa)

Leafy goldenrod is a perennial herb growing 1-5 feet in height from a basal rosette. Flowers are yellow. Leaves are lanceolate. It grows in dry woods, fields, and rocky slopes. It is recognized by pollination ecologists as "special value to native bees," attracting large numbers of native bees and as a plant that "supports conservation biological control," attracting predatory or parasitoid insects that prey upon pest insects. (UTA 2007a, Semple and Cook 2022)

3.7.8.2.41 Keeled Bur-reed (Sparganium androcladum)

Keeled bur-reed or branching bur-reed is a perennial herb with linear leaves growing up to 40 inches tall. Leaves have a conspicuous central keel. Flowers are spikes, with female flowerheads growing above male flowerheads. Fruits are brown and spindle-shaped, dull at the base and shiny toward the end. It grows in shores and shallow, quiet, circumneutral waters. (Kaul 2022)

3.7.8.2.42 Hobblebush (Viburnum lantanoides)

Hobblebush is a perennial 6-to-12-foot straggling shrub, often with pendulous outer branches which root where they touch the ground. It has fragrant, flat-topped clusters of small, white flowers, with the outer flowers larger than the inner ones. Leaves are 4-8 inches, opposite, and heart-shaped, turning red in the fall. Fruits are berries which change from red to blue. (UTA 2014)

3.7.8.2.43 Rock Serviceberry (Amelanchier sanguinea)

Rock serviceberry, or roundleaf serviceberry, is a low, straggling, or arching shrub, 3-8 feet tall, usually with a single, slender trunk. It grows in clumps but does not form colonies. Flowers are white or pinkish, growing in loose, nodding spikes. Fruits are dark-purple berries. Preferred habitats are hillsides; upland woods; rocky slopes. (UTA 2012)

3.7.8.2.44 American Beach Grass (Ammophila breviligulata)

American beach grass is a tall, erect, stiff perennial grass arising from long subsurface rhizomes. A leaf cluster surrounds an elongated flowering spike. It grows in back beaches and sand dunes, on the Atlantic coast and the lower Great Lakes. American beach grass is important as a dune stabilizer, producing a rhizome mat that is both vertical and horizontal, serving to knit dunes together. (UTA 2007b)

There is a record of American beach grass within a 1-mile radius of the PNPP site.

3.7.8.2.45 Cooper's Milk-vetch (Astragalus neglectus)

Cooper's milk-vetch is a perennial forb, 1-3 feet tall. Leaves are pinnately compound with oblong leaflets. Flowers are white, 0.5 inches, growing in racemes. Fruit is an inflated pod. Flowers and fruit are borne above the tallest leaves. Cooper's Milk-vetch is found in the woodland-prairie ecotone as well as on riverbanks, ravines, and lakeshores. (WDNR 2022c)

3.7.8.2.46 Leafy Tussock Sedge (Carex aquatilis)

Leafy tussock sedge, or water sedge, is a water-obligate, long-lived perennial. Culms are slender, sharply triangular, growing 6-60 inches tall. The leaves of water sedge are flat, elongate, 2-7 mm wide, and occur on the lower half of the culms. Flowers grow in three to 10 cylindrical spikelets 0.6-2 inches long. Fruits are lens-shaped achenes 1-2 mm wide. Leafy tussock sedge can reproduce asexually from rhizomes. It prefers moist environments such as riparian and wetland sites. (Hauser 2006)

3.7.8.2.47 Nodding Sedge (Carex gynandra)

Nodding sedge is a perennial growing 18-60 inches. Leaves are basal and alternate, up to 21 inches long. Bases are wrapped in a rough-textured, brown to reddish-purple sheath that becomes somewhat fibrous with maturity. Flowers are separate male and female spikes. Fruits are densely packed achenes. Nodding sedge grows in partial shade or full sun, in moist to wet habitats, such as bogs, swamps, along shores, wet ditches, and floodplain forests. (MW 2022b)

3.7.8.2.48 Sweet-fern (Comptonia peregrina)

Sweet-fern is a small, aromatic mound-shaped shrub, 2-4 feet tall, occurring in dense colonies. It grows multiple stems with loose, spreading branches. Leaves are long, narrow, olive-green, with rolled-back edges and rounded, fern-like division. Flowers are brown catkins that appear before the leaves unfold. Fruit is a small nut enclosed in a bur-like husk. It grows in partial shade in dry, open woods, roadsides, and sandy barrens. (UTA 2016)

3.7.8.2.49 Log Fern (Dryopteris celsa)

Log fern is a perennial woodfern with short creeping rhizomes. Leaves are dark green, pinnately compound, greater than 6 inches long. It reproduces by spores. It grows in partial sunlight to deep shade, occurring on rotting logs and rich soil in swamps and wet woods. It tolerates dry sites. (NCSEPT 2022a)

3.7.8.2.50 Least Spike-rush (Eleocharis parvula)

Least spike-rush is an obligate wetland plant, perennial and annual, growing up to 4 inches. Stems are spongy, forming dense mats. Leaves are simple, alternate, and linear. Flowers are inconspicuous spikes. It grows in mud and brackish marshes, and rarely in freshwater marshes. (USGS 2022c)

3.7.8.2.51 Mountain Bindweed (Fallopia cilinodis)

Mountain bindweed is a perennial twining or scrambling vine that grows to a length of up to 16 feet. Leaves are alternate, simple, ovate to triangular, 2-5 inches long with wavy margins, often with reddish veins. Flowers are panicles of inconspicuous greenish white, sometimes pinkish, 1.5-2 mm long. Fruit is a glossy black achene, 3-4 mm long. Mountain bindweed prefers recently disturbed areas, dry woods, thickets, rocky slopes, and forest edges. (Sonday 2013)

3.7.8.2.52 Canada St. John's-wort (Hypericum canadense)

Canada St. John's-wort is an annual or perennial erect herb. Leaves are simple, opposite, sessile, and linear, 0.5-5.5 mm in length. Flowers are five golden yellow petals, and sometimes red-veined, 5-6 mm in diameter. Fruit is a dry capsule that splits open when ripe. It grows in fens, marshes, depressions, and lake and pond margins. (Strother 2022)

3.7.8.2.53 Cow Wheat (Melampyrum lineare)

Cow wheat is an annual wildflower growing 6-16 inches in height. Leaves are simple, opposite, and lanceolate, often with two to four bristled teeth at the base. Flowers are creamy white, tubular, two-lipped, less than an inch in length. It grows on well-drained sites, often under pine trees and prefers dry to moist woods, bogs, and rocky barrens. (NCSEPT 2022b)

3.7.8.2.54 Thread-like Naiad (Najas gracillima)

Thread-like naiad is an annual, submerged aquatic plant with flexible stems up to 20 inches long. Leaves are 0.5 to 3 cm long, and minutely toothed. Flowers are tiny. Male flowers have a single anther; female flowers have a style. Fruit is a light brown seed, 2-3 mm long, dull and pitted. Thread-like naiad is found in oligotrophic lakes with soft water, often in calm, somewhat shallow water. (MNDNR 2022e)

3.7.8.2.55 Large-leaved Mountain-rice (Oryzopsis asperifolia)

Large-leaved mountain-rice is a perennial grass, growing 10-26 inches. Leaves are evergreen and mostly basal, 6-16 inches in length, tapering at both ends. Flowers are slender spikelets. Fruits are grains, 4-6.5 mm long that taper to a beak at the tip. Large-leaved mountain-rices grows in partial shade to full sun, in average to dry rocky soil, in open hardwood and mixed forest, Jack pine stands, and clearings. (MW 2022c)

3.7.8.2.56 White Wood-sorrel (Oxalis montana)

White wood-sorrel, or mountain woodsorrel, is a woodland perennial herb growing less than 4 inches high. White wood does not have a main stem. Leaves are evergreen and basal, with three cloverlike leaflets. It may produce white-pink flowers that reproduce sexually, or asexual flowers which do not open. Fruit are capsules which dehisce seeds forcefully, flinging them outward from the plant. It is found in rich, damp woods. (Pavek 1992)

3.7.8.2.57 Coastal Little Bluestem (Schizachyrium littorale)

Coastal little bluestem is a warm season bunchgrass, 1-2 feet high, with coarse blue-green stems and purplish basal leaves. Leaves are smooth but frequently are covered with hair at the base next to the sheath. Leaves tend to fold with maturity. Fruits are seed head clusters, approximately 3 inches long, and develop short, silvery hairs (awns) when the seeds are ripe, giving the plant a frosted appearance in early fall. Its preferred habitat is sand dunes of the Gulf of Mexico, Atlantic, and Great Lakes coasts. (USDA 2014)

3.7.8.2.58 Northern Poison Ivy (Toxicodendron rydbergii)

Northern poison ivy, or western poison ivy, is a rhizomatous, erect, low shrub with woody stems 2-48 inches. It has no aerial roots and does not climb. Leaves are alternate, compound, 1-6 inches with three leaflets. Flowers are white or yellow with five petals, occurring in loose clusters. Fruit is a small, dry round drupe, occurring in grape-like clusters. Most parts contain the oil urushiol, which causes a rash in about 80 percent of people. Poison-ivies occur in a variety of sites and soils, from open to shady sites and from dry to wet sites. They occur on flat to steep topography. They grow in riparian areas, on margins of ponds, and lakes, moist depressions, and swales, in marshes and swamps, and on dry barren flats, slopes, and bluffs. (Innes 2012)

3.7.8.2.59 Lyre-leaved Rock Cress (Arabidopsis lyrate)

Lyre-leaved rock cress is a small perennial or biennial mustard, growing 4-15.7 inches in height from a basal rosette. Basal leaves are hairy, 0.8-1.6 inches in length, while stem leaves are alternate and linear, with smooth margins and a tapering base. Flowers are white, four-lobed, and tiny, 0.1-0.3 inches. Fruits are wingless siliques 0.8-1.8 inches. Lyre-leaved rock cress inhabits thin soils and crevices of rocky cliff, outcrops, and ledges, in full to filtered sun. (MDFW 2015)

3.7.8.2.60 Necklace sedge (Carex projecta)

Carex projecta is a common sedge of moist to wet places found in floodplain forest, swales, swamps, wet meadows, ditches, and the margins of rivers, lakes, and ponds. It tolerates full sun but is more often found in shadier sites. (ENRTF 2022)

3.7.8.2.61 Bristly Sarsaparilla (Aralia hispida)

Bristly sarsaparilla, or pigeonberry, is a perennial subshrub growing 1-3 feet tall. Leaves are bipinnate, elliptical to oblong, and toothed. Flowers are tiny, 5-6 mm, with five white petals, growing in umbels. Fruits are black and berry-like. Bristly sarsaparilla occurs in woodlands, prairies, meadows, and fields. (UTA 2015b)

3.7.8.3 Species Protected Under the Bald and Golden Eagle Protection Act

Bald eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA). Bald eagles have been observed at the PNPP as recently as 2021. The BGEPA was originally enacted in 1940 (16 USC 668-668c) and it prohibits anyone without a permit issued by the Secretary of the Interior from "taking" bald eagles, including their parts, nests, eggs, or feathers. The BGEPA provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export, or import, at any time or any manner, any bald eagle… [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

"Disturb" means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle; 2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior: or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." In addition to immediate impacts, this definition also covers impacts resulting from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment. (USFWS 2022f)

There are currently no known eagle nests onsite; therefore, no BGEPA permitting requirements associated with PNPP site operations or in-scope transmission lines. Current and future bald eagle nests located on the PNPP site would be subject to all protections under the BGEPA.

3.7.8.4 Species Protected Under the Migratory Bird Treaty Act

In addition to species protected under federal and state endangered species acts, there are numerous bird species protected under the Migratory Bird Treaty Act (MBTA) that may visit PNPP. The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter or offer for sale, or purchase or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations.

The PNPP site is located in the Mississippi Flyway, one of four administrative flyways established in North America to facilitate management of migratory birds and their habitats (USFWS 2022g). Numerous species of migratory birds likely use the project corridor during the spring and fall migrations, as summer residents, and as winter visitors. According to the USFWS, 16 birds of conservation concern have the potential to occur in Lake County, Ohio: Bald eagle (*Haliaeetus leucocephalus*), black-billed cuckoo (*Coccyzus erythropthalmus*), blue-winged warbler (*Vermivora pinus*), bobolink (*Dolichonyx oryzivorus*), Canada warbler (*Cardellina canadensis*), Cerulean warbler (*Dendroica cerulea*), evening grosbeak (*Coccothraustes vespertinus*), golden eagle (*Aquila chrfalconysaetos*), golden-winged warbler (*Vermivora chrysoptera)*, lesser yellowlegs (*Tringa flavipes*), long-eared owl (Asio otus), prairie warbler (*Dendroica discolor*), red-headed woodpecker (*Melanerpes erythrocephalus*), ruddy turnstone (*Arenaria interpres morinella*), short-billed dowitcher (*Limnodromus griseus*), and wood thrush (*Hylocichla mustelina*). (USFWS 2022b)

Suitable habitat is potentially present on the PNPP site and in the immediate vicinity for all of the species listed above. Lesser yellowlegs, Ruddy turnstone, short-billed dowitcher occur as migrants through Lake County and may utilize stop-over habitat available onsite or in the vicinity. These species are known to breed elsewhere. The other 13 migratory bird species are known to breed in Lake County (USFWS 2022b). Peregrine falcons are known to nest at the PNPP site.

3.7.8.5 Essential Fish Habitat

Essential fish habitat (EFH) is defined under the Magnuson-Stevens Fishery Conservation and Management Act and refers to waters and substrate necessary for fish to spawn, breed, feed or grow to maturity. The NOAA is responsible for identifying and describing EFH for sharks, tuna, and other highly migratory species that cross regional boundaries. NOAA only provides EFH for federally managed fish and invertebrates.

A review of the NOAA EFH was conducted to determine the location of EFH within 6 miles of PNPP. No EFH is located within the 6-mile vicinity of PNPP, nor were any EFH areas protected from fishing. As habitat areas of particular concern (HAPC) are derived from EFH, there were also no HAPCs located within the 6-mile vicinity of PNPP (NOAA 2022d)

Table 3.7-1 Recreational and Commercial Fish Species Recorded in Lake Erie Between 1987 and 2020

Common Name	Scientific Name
Alewife	A*losa pseudoharengus*
American gizzard shad	*Dorosoma cepedianum*
Black bullhead	*Ameiurus melas*
Buffalo	*Ictiobus cyprinellus*
Burbot	Lota
Carp	*Cyprinid* spp.
Channel catfish	*Ictalurus punctatus*
Emerald shiner	*Notropis atherinoides*
Freshwater drum	*Aplodinotus grunniens*
Goldfish	*Carassius* spp.
Lake whitefish	*Coregonus clupeaformi*
Quillback	*Carpiodes cyprinus*
Rainbow smelt	*Osmerus mordax*
Silver chub	*Macrhybopsis storeriana*
Smallmouth bass	*Micropterus dolomieu*)
Spottail shiner	*Notropis hudsonius*)
Suckers	*Catostomus* spp.
Trout perch	*Percopsis omiscomaycus*
Walleye	*Sander vitreus*)
White bass	*Morone chrysops*
White perch	*Morone americana*
Yellow perch	*Perca flavescens*

(ODNR 2021a)

Table 3.7-2 Phytoplankton and Zooplankton Recorded in Lake Erie in the Vicinity of the PNPP Site (Sheet 1 of 4)

Phytoplankton	Zooplankton
Cyanophyta	**Protozoans**
Chroococcus dispersus	*Acanthocystis spp.*
Chroococcus giganteus	*Carchesium polypinum*
Chroococcus limneticum	*Codonella cratera*
Chroococcus minutus	*Difflugia oblonga*
Chroococcus turgidum	*Vorticella microstoma*
Chroococcus sp.	*Vorticella sp*
Aphanocapsa delicatissima	*ROTIFERS*
Merismopedia elegans	*Ascomorpha sultans*
Merismopedia glauca	*Ascomorphella volvocicola*
Microcystis aeruginosa	*Asplanchna priodonte*
Microcystis flos-aquae	*Brachionus angularis*
Microcystis sp.	*Brachionus harenensi*
Coelosphaerium kuetzingiana	*Brachionus plicatilis*
Gomphosphaeria aponina	*Brachionus quadridentata*
Gomphosphaeria lacustris	*Cephalodella gibba*
Oscillatoria tenuis	*Chromugaster ovalis*
Oscillatoria sp.	*Colurella obtusa*
Anabaena flos-aquae	*Filinia lonqiseta*
Anabaena sp.	*Kellicottia longispina*
Aphanizomenon flos-aquae	*Keratella cochlearis*
Chlorophyta	*Keratella qualdrata*
Phacotus lenticularis	*Notholca acuminata*
Chlamydomonas globosa	*Notholca squamula*
Pandorina morum	*Notholca labis*
Eudorina elegans	*Notholca squamula*
Sphaerocystis schroeteri	*Polyarthra euryptera*
Gleocystis planctonica	*Polyarthra longirimis*
Pediastrum boryanum	*Polyarthra major*
Pediastrum duplex	*Polvarthra vulqaris*
Pediastrum simplex	*Svnchaeta oblonqa*
Coelastrum cambricum	*Svnchaeta pectinata*
Coelastrum microporum	*Svnchaeta stvlata*
Coelastrum reticulatum	*Trichorerca lonqiseta*
Dictyosphaerium pulchellum	*Trichocerca multicrinis*
Dictyosphaerium sp.	*Trichocerca similis*
Golenkinia paucispina	*Cyclops bicuspidatus*
Golenkinia radiata	*Cvclops vernalis*
Oocystis elliptica	*Diaptomus minutus*
Oocystis parva	*Diaptomus sicilis*
Oocystis solitaria	*Diaptomus siciloides*
Oocystis submarina	*Mesocvclops edax*

Table 3.7-2 Phytoplankton and Zooplankton Recorded in Lake Erie in the Vicinity of the PNPP Site (Sheet 2 of 4)

Phytoplankton	Zooplankton
Oocystis sp.	*Tropocvclops prasinis*
Lagerheimia ciliata	*Nauplii*
Schroederia setigera	*Copepodid*
Ankistrodesmus falcatus	*Copepod unidentified*
Closteriopsis longissima	*Cladocerats*
Quadrigula closterioides	*Alonella nana*
Quadrigula lacustris	*Bosmina coregoni*
Tetraedron limneticum	*Bosmina longirostris*
Tetraedron regulare	*Ceriodaphnia reticulata*
Tetraedron sp.	*Chydorus sphaericus*
Scenedesmus acuminatum	*Daphnia dubia*
Scenedesmus armatus	*Daphnia galeata mendotae*
Scenedesmus armatus var. bicaudatus	*Daphnia pulex*
Scenedesmus bernardii	
Scenedesmus bijuga	*Daphnia retrocurva*
Scenedesmus braziliensis	*Holopedium qibberum*
Scenedesmus denticula	*Leptodora kindtii*
Scenedesmus dimorphus	
Scenedesmus quadricauda	
Scenedesmus sp.	
Crucigenia rectangularis	
Crucigenia tetrapedia	
Crucigenia quadrata	
Kirchneriella curvata	
Kirchneriella obesa	
Kirchneriella ovalis	
Kirchneriella subsolitaria	
Kirchneriella sp.	
Micractinium pusillum	
Micractinium sp.	
Mougeotia viridis	
Closterium acutum	
Closterium dianae	
Closterium gracile	
Closterium moniliferum	
Closterium parvulum	
Closterium pseudodianae	
Closterium turgidum	
Closterium venus	

Table 3.7-2 Phytoplankton and Zooplankton Recorded in Lake Erie in the Vicinity of the PNPP Site (Sheet 3 of 4)

Phytoplankton	Zooplankton
Closterium sp.	
Staurastrum chaetoceros	
Staurastrum gracile	
Staurastrum paradoxum	
Cosmarium botrytis	
Cosmarium constrictum	
Cosmarium depressum	
Cosmarium formosum	
Cosmarium margaritaceum	
Cosmarium pseudoprotuberans	
Cosmarium sp.	
unidentified green #1	
Euglenophyta	
Trachelomonas hispida	
Trachelomonas sp.	
Pyrrhophyta	
Glenodinium quadridens	
Gymnodinium palustre	
Peridinium cinctum	
Peridinium pusillum	
Ceratium hirundinella	
Cryptomonas sp.	
Chrysophyta	
Melosira ambigua	
Melosira binderana	
Melosira distans	
Melosira granulata	
Melosira mutica	
Melosira varians	
Cyclotella comta	
Cyclotella glomerata	
Cyclotella keutzingiana	
Cyclotella sp.	
Stephanodiscus hantzschii	
Stephanodiscus niagarae	
Coscinodiscus lacustris	
Meridion circulare	
Diatoma hiemale	
Tabellaria fenestrata	
Fragilaria capucina	
Fragilaria crotonensis	
Fragilaria intermedia	

Table 3.7-2 Phytoplankton and Zooplankton Recorded in Lake Erie in the Vicinity of the PNPP Site (Sheet 4 of 4)

Phytoplankton	Zooplankton
Fragilaria pinnata	
Asterionella formosa	
Asterionella sp.	
Synedra acus	
Synedra ulna	
Eunotia pectinalis	
Achnanthes flexiella	
Cocconeis pediculus	
Cocconeis placentula	
Pleurosigma sp.	
Navicula confervaceae	
Navicula cuspidata	
Navicula dicephala	
Navicula mutica	
Navicula radiosa	
Navicula sp.	
Gomphonema angustatum	
Gomphonema olivaceum	
Cymbella tumida	
Cymbella sp.	
Hantzschia virgata	
Nitzschia acicularis	
Nitzschia cuspidata	
Nitzschia hungarica	
Nitzschia linearis	
Nitzschia palea	
Nitzschia sigma	
Nitzschia sigmoidea	
Nitzschia tryblionella	
Nitzschia sp.	
Cymatopleura solea	
Surirella ovalis	

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 1 of 11)

Common Name	Species Name
Amphibians	
Allegheny Mountain Dusky Salamander	*Desmognathus ochrophaeus*
American Bullfrog	*Lithobates catesbeianus*
American Toad	*Anaxyrus americanus*
Common Mudpuppy	*Necturus maculosus*
Eastern Red-backed Salamander	*Plethodon cinereus*
Four-toed Salamander	*Hemidactylium scutatum*
Fowler's Toad	*Anaxyrus fowleri*
Gray Treefrog	*Hyla chrysoscelis*
Jefferson Salamander	*Ambystoma jeffersonianum*
Marbled Salamander	*Ambystoma opacum*
Northern Dusky Salamander	*Desmognathus fuscus*
Northern Green Frog	*Lithobates clamitans melanota*
Northern Leopard Frog	*Lithobates pipiens*
Northern Red Salamander	*Pseudotriton ruber ruber*
Northern Slimy Salamander	*Plethodon glutinosus*
Northern Two-lined Salamander	*Eurycea bislineata*
Pickerel Frog	*Lithobates palustris*
Red-spotted Newt	*Notophthalmus viridescens*
Small-mouthed Salamander	*Ambystoma texanum*
Spotted Salamander	*Ambystoma maculatum*
Spring Peeper	*Pseudacris crucifer*
Wood Frog	*Lithobates sylvaticus*
Reptiles	
Eastern Gartersnake	*Thamnophis sirtalis*
Eastern Milksnake	*Lampropeltis triangulum*
Gray (Black) Ratsnake	*Pantherophis spiloides*
Midland Painted Turtle	*Chrysemys picta marginata*
Northern Watersnake	*nerodia sipedon sipedon*
Snapping Turtle	*Chelydra serpentina*
Mammals	
American Beaver	*Castor canadensis*
American Black Bear	*Ursus americanus*
American Mink	*Neovison vison*
Big Brown Bat	*Eptesicus fuscus*
Brown Rat	*Rattus norvegicus*
Common Muskrat	*Ondatra zibethicus*
Coyote	*Canis latrans*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 2 of 11)

Common Name	Species Name
Easter Fox Squirrel	*Sciurus niger*
Eastern Chipmunk	*Tamias striatus*
Eastern Mole	*Scalopus aquaticus*
Eastern Red Bat	*Lasiurus borealis*
Ermine	*Mustela erminea*
Evening Bat	*Nycticeius humeralis*
Hairy-tailed Mole	*Parascalops breweri*
Hoary Bat	*Lasiurus cinereus*
Houst Mouse	*Mus musculus*
Indiana Bat	*Myotis sodalis*
Least Weasel	*Mustela nivalis*
Little Brown Bat	*Myotis lucifugus*
Long-tailed Weasel	*Mustela frenata*
Masked Shrew	*Sorex cinereus*
Meadow Vole	*Microtus pennsylvanicus*
North American Least Shrew	*Cryptotis parva*
North American River Otter	*Lontra canadensis*
Northern Long-eared Bat	*Myotis septentrionalis*
Northern Short-tailed Shrew	*Blarina brevicauda*
Raccoon	*Procyon lotor*
Red Squirrel	*Tamiasciurus hudonicus*
Silver-haired Bat	*Lasionycteris noctivagans*
Smoky Shrew	*Sorex fumeus*
Snowshoe Hare	*Lepus americanus*
Southern Bog Lemming	*Synaptomys cooperi*
Star-nosed Mole	*Condylura cristata*
Tri-colored Bat	*Perimyotis subflavus*
Viginia Opossum	*Didelphis virginiana*
White-footed Deermouse	*Peromyscus leucopus*
White-tailed Deer	*Odocoileus virginianus*
Woodchuck	*Marmota monas*
Woodland Jumping Mouse	*Napaeozapus insignis*
Birds	
Acadian Flycatcher	*Empidonax virescens*
Alder Flycatcher	*Empidonax alnorum*
American Avocet	*Recurvirostra americana*
American Bittern	*Botaurus lentiginosus*
American Black Duck	*Anas rubripes*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 3 of 11)

Common Name	Species Name
American Coot	*Fulica americana*
American Crow	*Corvus brachyrhynchos*
American Golden-Plover	*Pluvaialis dominica*
American Goldfinch	*Spinus tristis*
American Kestrel	*Falco sparverius*
American Pipit	*Anthus rubescens*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
American Tree Sparrow	*Spizelloides arborea*
American White Pelican	*Pelecanus erythrorhynchos*
American Wigeon	*Mareca americana*
American Woodcock	*Scolopax minor*
Arctic Loon	*Gavia arctica*
Baird's Sandpiper	*Calidris bairdii*
Bald Eagle	*Haliaeetus leucocephalus*
Baltimore Oriole	*Icterus galbula*
Bank Swallow	*Riparia riparia*
Barn Owl	*Tyto alba*
Barn Swallow	*Hirundo rustica*
Barred Owl	*Strix varia*
Barrow's Goldeneye	*Bucephala islandica*
Bay-breated Warbler	*Setophaga castanea*
Bell's Vireo	*Vireo bellii*
Belted Kingfisher	*Megaceryle alcyon*
Black Scoter	*Melanitta americana*
Black Tern	*Chlidonias niger*
Black Vulture	*Coragyps atratus*
Black-and-white Warbler	*Mniotilta varia*
Black-backed Woodpecker	*Picoides arcticus*
Black-bellied Plover	*Pluvialis squatarola*
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Blackburnian Warbler	*Setophaga fusca*
Black-capped Chickadee	*Poecile atricapillus*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Black-headed Gull	*Chroicocephalus ridibundus*
Black-legged Kittiwake	*Rissa tridactyla*
Blackpoll Warbler	*Setophaga striata*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 4 of 11)

Common Name	Species Name
Black-throated Blue Warbler	*Setophaga caerulescens*
Black-throated Green Warbler	*Setophaga virens*
Blue Grosbeak	*Passerina caerulea*
Blue Jay	*Cyanocitta cristata*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Blue-headed Vireo	*Vireo solitarius*
Blue-winged Teal	*Spatula discors*
Blue-winged Warbler	*Vermivora cyanoptera*
Bobolink	*Dolichonyx oryzivorus*
Bohemian Waxwing	*Bombycilla garrulus*
Bonaparte's Gull	*Chroicocephalus philadelphia*
Boreal Owl	*Aegoius funereus*
Brant	*Branta bernicla*
Brewer's Blackbird	*Euphagus cyanocephalus*
Broad-winged Hawk	*Buteo platypterus*
Brown Creeper	*Certhia americana*
Brown Pelican	*Pelecanus occidentalis*
Brown Thrasher	*Toxostoma rufum*
Brown-headed Cowbird	*Molothrus ater*
Buff-breasted Sandpiper	*Calidris subruficollis*
Bufflehead	*Bucephala albeola*
Cackling Goose	*Branta hutchinsii*
California Gull	*Larus californicus*
Canada Goose	*Branta Canadensis*
Canada Warbler	*Cardellina canadensis*
Canvasback	*Anythya valisineria*
Cape May Warbler	*Setophaga tigrina*
Carolina Wren	*Thryothorus ludovicianus*
Caspian Tern	*Hydrocoloeus caspia*
Cattle Egret	*Bubulcus ibis*
Cave Swallow	*Petrochelidon fulva*
Cedar Waxwing	*Bombycilla cedrorum*
Cerulean Warbler	*Setophaga cerulea*
Chestnut-sided Warbler	*Setophaga pensylvanica*
Chestunt-collared Longspur	*Calcarius ornatus*
Chimney Swift	*Chaetura pelagica*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallid*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 5 of 11)

Common Name	Species Name
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Eider	*Somateria mollissima*
Common Gallinule	*Gallinula galeata*
Common Goldeneye	*Bucephala clangula*
Common Grackle	*Quiscalus quiscala*
Common Loon	*Gavia immer*
Common Merganser	*Mergus merganser*
Common Nighthawk	*Chordeiles minor*
Common Raven	*Corvus corax*
Common Redpoll	*Acanthis flammea*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Connecticut Warbler	*Opornis agilis*
Cooper's Hawk	*Accipiter cooperii*
Dark-eyed Junco	*Junco hyemalis*
Dickcissel	*Spiza americana*
Double-crested Cormorant	*Nannopterum auritum*
Downy Woodpecker	*Dryobates pubescens*
Dunlin	*Calidris alpina*
Eared Grebe	*Podiceps nigricollis*
Eastern Bluebird	*Sialia sialis*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Meadowlark	*Sturnella magna*
Eastern Phoebe	*Sayornis phoebe*
Eastern Screech-Owl	*Megascops asio*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Whip-poor-will	*Antrostomus vociferus*
Eastern Wood-Pewee	*Contopus virens*
Eurasian Wigeon	*Mareca penelope*
European Starling	*Sturnus vulgaris*
Evening Grosbeak	*Coccothraustes vespertinus*
Field Sparrow	*Spizella pusilla*
Fish Crow	*Corvus ossifragus*
Forster's Tern	*Sterna forsteri*
Fox Sparrow	*Passerella iliaca*
Franklins' Gull	*Leucophaeus pipixcan*
Gadwall	*Mareca strepera*
Glaucous Gull	*Larus hyperboreus*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 6 of 11)

Common Name	Species Name
Glossy Ibis	*Plegadis falcinellus*
Golden Eagle	*Aquila chrysaetos*
Golden-crowned Kinglet	*Regulus satrapa*
Golden-winged Warbler	*Vermivora chrysoptera*
Grasshopper Sparrow	*Ammodramus savannarum*
Gray Catbird	*Dumetella carolinensis*
Gray Flycatcher	*Empidonax wrightii*
Gray-cheeked Thrush	*Catharus minimus*
Great Black-backed Gull	*Larus marinus*
Great Blue Heron	*Ardea herodias*
Great Crested Flycatcher	*Myiarchus crinitus*
Great Egret	*Ardea alba*
Great Horned Owl	*Bubo virginianus*
Greater Scaup	*Aythya marila*
Greater White-fronted Goose	*Anser albifrons*
Greater Yellowlegs	*Tringa melanoleuca*
Green Heron	*Butorides virescens*
Green-tailed Towhee	*Piplio chlorusus*
Green-winged Teal	*Anas crecca*
Gryfalcon	*Falco rusticolus*
Hairy Woodpecker	*Dryobates villosus*
Harlequin Duck	*Histrionicus histrionicus*
Harris' Sparrow	*Zonotrichia querula*
Henslow's Sparrow	*Centronyx henslowii*
Hermit Thrush	*Catharus guttatus*
Herring Gull	*Larus argentatus*
Hoary Redpoll	*Acanthis hornemanni*
Hooded Merganser	*Lophodytes cucullatus*
Hooded Warbler	*Setophaga citrina*
Horned Grebe	*Podiceps auritus*
Horned Lark	*Eremophila alpestris*
House Finch	*Haemorhous mexicanus*
House Sparrow	*Passer domesticus*
House Wren	*Troglodytes aedon*
Hudsonian Godwit	*Limosa haemastica*
Iceland Gull	*Larus glaucoides*
Indigo Bunting	*Passerina cyanea*
Kentucky Warbler	*Geothlypis formosa*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 7 of 11)

Common Name	Species Name
Killdeer	*Charadrius vociferus*
King Eider	*Somateria spectabilis*
King Rail	*Rallus elaegans*
Kirtland's Warbler	*Setophaga kirtlandii*
Lapland Longspur	*Calcarius lapponicus*
Lark Sparrow	*Chondestes grammacus*
Laughing Gull	*Leucophaeus atricilla*
Least Bittern	*Ixobrychus exilis*
Least Flycatcher	*Empidonax minimus*
Least Sandpiper	*Calidris minutilla*
LeConte's Sparrow	*Ammospiza leconteii*
Lesser Black-backed Gull	*Larus fuscus*
Lesser Scaup	*Aythya affinis*
Lesser Yellowlegs	*Tringa flavipes*
Limpkin	*Aramus guarauna*
Lincoln's Sparrow	*Melospiza lincolnii*
Little Blue Heron	*Egretta caerulea*
Little Gull	*Hydrocoloeus minutus*
Loggerhead Shrike	*Lanius ludovicianus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Long-eared Owl	*Asio otus*
Long-tailed Duck	*Clangula hyemalis*
Long-tailed Jaeger	*Stercorarius longicaudus*
Louisiana Waterthrush	*Parkesia motacilla*
Magnolia Warbler	*Setophaga magnolia*
Mallard	*Anas platyrhynchos*
Marbled Godwit	*Limosa fedoa*
Marsh Wren	*Cistothorus palustris*
Merlin	*Falco columbaris*
Mississippi Kite	*Ictinia mississippiensis*
Mourning Dove	*Zenaida macroura*
Mourning Warbler	*Geothlypis philadelphia*
Mute Swan	*Cygnus olor*
Nashville Warbler	*Leiothlypis ruficapilla*
Nelson's Sparrow	*Ammospiza nelsoni*
Neotropic Cormorant	*Nannopterum brasilianum*
Northern Bobwhite	*Colinus virginianus*
Northern Cardinal	*Cardinalis cardinalis*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 8 of 11)

Common Name	Species Name
Northern Flicker	*Colaptes auratus*
Northern Gannet	*Morus bassanus*
Northern Goshawk	*Accipiter gentilis*
Northern Harrier	*Circus hudonius*
Northern Mockingbird	*Mimus polyglottos*
Northern Parula	*Setophaga americana*
Northern Pintail	*Anas acuta*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Northern Saw-whet Owl	*Aegolius acadicus*
Northern Shoveler	*Spatula clypeata*
Northern Shrike	*Lanius borealis*
Northern Waterthrush	*Parkesia noveboracensis*
Northern Wheatear	*Oenanthe oenanthe*
Olive-sided Flycatcher	*Contopus cooperi*
Orange-crowned Warbler	*Leiothlypis celata*
Orchard Oriole	*Icterus spurius*
Osprey	*Pandion haliaetus*
Ovenbird	*Seiurus aurocapilla*
Pacific Loon	*Gavia pacifica*
Palm Warbler	*Setophaga palmarum*
Parasitic Jaeger	*Stercorarius parasiticus*
Pectoral Sandpiper	*Calidris melanotos*
Peregrine Falcon	*Falco peregrinus*
Philadelphia Vireo	*Vireo philadelphicus*
Pied-billed Grebe	*Podilymbus podiceps*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Grosbeak	*Pinicola enucleator*
Pine Siskin	*Spinus pinus*
Pine Warbler	*Setophaga pinus*
Piping Plover	*Charadrius melodu*
Pomarine Jaeger	*Stercorarius pomarinus*
Prairie Warbler	*Setophaga discolor*
Prothonotary Warbler	*Protonotaria citrea*
Purple Finch	*Haemorhous purpureus*
Purple Gallinule	*Porphyrio martinica*
Purple Martin	*Progne subis*
Purple Sandpiper	*Calidris maritima*
Red Crossbill	*Loxia curvirostra*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 9 of 11)

Common Name	Species Name
Red Knot	*Calidris canutus*
Red Phalarope	*Phalaropus fulicarius*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-breasted Merganser	*Mergus serrator*
Red-breasted Nuthatch	*Sitta canadensis*
Red-eyed Vireo	*Vireo olivaceus*
Redhead	*Aythya americana*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-necked Grebe	*Podiceps grisegena*
Red-necked Phalarope	*Phalaropus lobatus*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-throated Loon	*Gavia stellata*
Red-winged Blackbird	*Agelaius phoeniceus*
Ring-billed Gull	*Larus delawarensis*
Ring-necked Duck	*Aythya collaris*
Ring-necked Pheasant	*Phasianus colchicus*
Rock Pigeon	*Columba livia*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ross's Goose	*Anser rossii*
Ross's Gull	*Rhodostethia rosea*
Rough-legged Hawk	*Buteo lagopus*
Ruby-crowned Kinglet	*Corthylio calendula*
Ruby-throated Hummingbird	*Archilochus colubris*
Ruddy Duck	*Oxyura jamaicensis*
Ruddy Turnstone	*Arenaria interpres*
Ruffed Grouse	*Bonasa umbellus*
Rufous Hummingbird	*Selasphorus rufus*
Rusty Blackbird	*Euphagus carolinus*
Sabine's Gull	*Xema sabini*
Sanderling	*Calidris alba*
Sandhill Crane	*Antigone canadensis*
Savannah Sparrow	*Passerculus sandichensis*
Say's Phoebe	*Sayornis saya*
Scarlet Tanager	*Prianga olivacea*
Scissor-tailed Flycatcher	*Tyrannus forficatus*
Sedge Wren	*Cistothorus stellaris*
Semipalmated Plover	*Charadrius semipalmatus*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 10 of 11)

Common Name	Species Name
Semipalmated Sandpiper	*Calidris pusilla*
Sharp-shinned Hawk	*Accipiter striatus*
Short-billed Dowitcher	*Limnodromus griseus*
Short-billed Gull	*Larus brachyrhynchus*
Short-eared Owl	*Asio flammeus*
Snow Bunting	*Plectrophenax nivalis*
Snow Goose	*Anser caerulescen*
Snowy Egret	*Egretta thula*
Snowy Owl	*Bubo scandiacus*
Snowy Plover	*Charadrius nivosus*
Solitary Sandpiper	*Tringa solitaria*
Song Sparrow	*Melospiza melodia*
Sora	*Porzana carolina*
Spotted Sandpiper	*Actitis macularius*
Spotted Towhee	*Pipilo maculatus*
Stilt Sandpiper	*Calidris himantopus*
Summer Tanager	*Piranga rubra*
Surf Scoter	*Melanitta perspicillata*
Swainson's Hawk	*Buteo swainsoni*
Swainson's Thrush	*Catharus ustulatus*
Swainson's Warbler	*Limnothlypis swainsonii*
Swallow-tailed Kite	*Elanoides forficatus*
Swamp Sparrow	*Melopsiza georgiana*
Tennessee Warbler	*Leiothlypis peregrina*
Thick-billed Murre	*Uria lomvia*
Townsend's Solitaire	*Myadestes townsendi*
Tree Swallow	*Tachycineta bicolor*
Tripical Kingbird	*tyrannus melancholicus*
Trumpeter Swan	*Cygnus buccinator*
Tufted Titmouse	*Baeolophus bicolor*
Tundra Swan	*Cygnus columbianus*
Turkey Vulture	*Cathartes aura*
Upland Sandpiper	*Bartramia longicauda*
Varied Thrush	*Ixoreus naevius*
Veery	*Catharus fuscescens*
Vermilion Flycatcher	*Pyrocephalus rubinus*
Vesper Sparrow	*Pooecetes gramineus*

Table 3.7-3 Terrestrial Species Likely to be Observed in Lake County, Ohio (Sheet 11 of 11)

Common Name	Species Name
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
Western Grebe	*Aechmophorus occidentalis*
Western Kingbird	*Tyrannus verticalis*
Western Meadowlark	*Sturnella neglecta*
Western Sandpiper	*Calidris mauri*
Whimbrel	*Numenius phaeopus*
White-breasted Nuthatch	*Sitta carolinensis*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-eyed Vireo	*Vireo griseus*
White-rumped Sandpiper	*Calidris fuscicollis*
White-throated Sparow	*Zonotrichia albicollis*
White-winged Crossbill	*Loxia leucoptera*
White-winged Dove	*Zenaida asiatica*
White-winged Scoter	*Melanitta deglandi*
Wild Turkey	*Meleagris gallopava*
Willet	*Tringa semipalmata*
Willow Flycatcher	*Empidonax traillii*
Wilson's Phalarope	*Phalaropus tricolor*
Wilson's Snipe	*Gallinago delicata*
Wilson's Warbler	*Cardellina pusilla*
Winter Wren	*Troglodytes hiemalis*
Wood Duck	*Aix sponsa*
Wood Stork	*Mycteria americana*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Yellow Rail	*Coturnicops noveboracensis*
Yellow Warbler	*Setophaga petechia*
Yellow-bellied Flytcatcher	*Empidonax flaviventris*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-breasted Chat	*Icteria virens*
Yellow-crowed Night-Heron	*Nyctanassa violacea*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Yellow-rumped Warbler	*Setophaga coronata*
Yellow-throated Vireo	*Vireo flavifrons*
Yellow-throated Warbler	*Setophaga dominica*

(CU 2021; ODNR 2012; ODNR 2016b; ODNR 2018c)

Table 3.7-4 Threatened and Endangered Species Listed in the vicinity of PNPP or in Lake County, Ohio (Sheet 1 of 3)

Common Name	Species Name	State Status	Federal Status
Birds			
Black-crowned night-heron	*Nycticorax nycticorax*	Threatened	Not Listed
Lark sparrow	*Chondestes grammacus*	Endangered	Not Listed
Least bittern	*Ixobrychus exilis*	Threatened	Not Listed
Northern harrier	*Circus hudsonius*	Endangered	Not Listed
Piping plover	*Charadrius melodus*	Not Listed	Endangered
Red knot	*Calidris canutus rufa*	Not Listed	Endangered
Upland sandpiper	*Bartramia longicauda*	Endangered	Not Listed
Insects			
Boreal bluet	*Enallagma boreale*	Threatened	Not Listed
Green-faced clubtail	*Gomphus viridifrons*	Threatened	Not Listed
Lilypad forktail	*Ischnura kellicotti*	Endangered	Not Listed
Marsh bluet	*Enallagma ebrium*	Threatened	Not Listed
Monarch butterfly	*Danaus plexippus*	Not Listed	Candidate
none	*Chimarra socia*	Endangered	Not Listed
none	*Psilotreta indecisa*	Threatened	Not Listed
none	*Rheopelopia acra*	Endangered	Not Listed
Northern bluet	*Enallagma cyathigerum*	Threatened	Not Listed
Racket-tailed emerald	*Dorocordulia libera*	Endangered	Not Listed
Riffle snaketail	*Ophiogomphus carolus*	Threatened	Not Listed
Uhler's sundragon	*Helocordulia uhleri*	Endangered	Not Listed
Fish			
American eel	*Anguilla rostrata*	Threatened	Not Listed
Cisco	*Coregonus artedi*	Endangered	Not Listed
Iowa darter	*Etheostoma exile*	Endangered	Not Listed
Lake sturgeon	*Acipenser fulvescens*	Endangered	Not Listed
Northern brook lamprey	*Ichthyomyzon fossor*	Endangered	Not Listed
Pugnose minnow	*Opsopoeodus emiliae*	Endangered	Not Listed
Shortnose gar	*Lepisosteus platostomus*	Endangered	Not Listed
Mammal			
Black bear	*Ursus americanus*	Endangered	Not Listed
Indiana bat	Myotis sodalist	Not Listed	Endangered
Northern long-eared bat	*Myotis septentrionalis*)	Not Listed	Threatened
Mussels			
Black sandshell	*Ligumia recta*	Threatened	Not Listed
Eastern pondmussel	*Ligumia nasuta*	Endangered	Not Listed
Fawnsfoot	*Truncilla donaciformis*	Threatened	Not Listed

Table 3.7-4 Threatened and Endangered Species Listed in the vicinity of PNPP or in Lake County, Ohio (Sheet 2 of 3)

Common Name	Species Name	State Status	Federal Status
Snuffbox	*Epioblasma triquetra*	Endangered	Endangered
Threehorn wartyback	*Obliquaria reflexa*	Threatened	Not Listed
Reptiles			
Eastern Massasauga rattlesnake	*Sistrurus catenatus*	Not Listed	Threatened
Spotted turtle	*Clemmys guttata*	Threatened	Not Listed
Plants			
Alpine rush	*Juncus alpinoarticulatus*	Threatened	Not Listed
American beach grass	*Ammophila breviligulata*	Threatened	Not Listed
Bristly sarsaparilla	*Aralia hispida*	Endangered	Not Listed
Bushy cinquefoil	*Potentilla paradoxa*	Threatened	Not Listed
Canada hawkweed	*Hieracium umbellatum*	Threatened	Not Listed
Canada St. John's-wort	*Hypericum canadense*	Endangered	Not Listed
Coastal little bluestem	*Schizachyrium littorale*	Endangered	Not Listed
Cooper's milk-vetch	*Astragalus neglectus*	Threatened	Not Listed
Cow-wheat	*Melampyrum lineare*	Endangered	Not Listed
Dwarf bulrush	*Lipocarpha micrantha*	Threatened	Not Listed
Early buttercup	*Ranunculus fascicularis*	Threatened	Not Listed
Few-flowered St. John's-wort	*Hypericum ellipticum*	Threatened	Not Listed
Flat-stemmed pondweed	*Potamogeton zosteriformis*	Threatened	Not Listed
Hobblebush	*Viburnum lantanoides*	Threatened	Not Listed
Inland beach pea	*Lathyrus japonicus*	Threatened	Not Listed
Keeled bur-reed	*Sparganium androcladum*	Threatened	Not Listed
Large-leaved mountain-rice	*Oryzopsis asperifolia*	Endangered	Not Listed
Leafy goldenrod	*Solidago squarrosa*	Threatened	Not Listed
Leafy tussock sedge	*Carex aquatilis*	Threatened	Not Listed
Least spike-rush	*Eleocharis parvula*	Endangered	Not Listed
Log fern	*Dryopteris celsa*	Endangered	Not Listed
Lyre-leaved rock cress	*Arabidopsis lyrata*	Endangered	Not Listed
Mountain bindweed	*Fallopia cilinodis*	Endangered	Not Listed
Necklace sedge	*Carex projecta*	Threatened	Not Listed
Nodding sedge	*Carex gynandra*	Endangered	Not Listed
Northern poison-ivy	*Toxicodendron rydbergii*	Endangered	Not Listed
Rock serviceberry	*Amelanchier sanguinea*	Threatened	Not Listed

Table 3.7-4 Threatened and Endangered Species Listed in the vicinity of PNPP or in Lake County, Ohio (Sheet 3 of 3)

Common Name	Species Name	State Status	Federal Status
Rock-harlequin	*Corydalis sempervirens*	Threatened	Not Listed
Short-fringed sedge	*Carex crinita var. brevicrinis*	Threatened	Not Listed
Sweet-fern	*Comptonia peregrina*	Endangered	Not Listed
Thread-like naiad	*Najas gracillima*	Endangered	Not Listed
White wood-sorrel	*Oxalis montana*	Endangered	Not Listed
Yellow vetchling	*Lathyrus ochroleucus*	Threatened	Not Listed

(ODNR 2016a; ODNR 2020; USFWS 2022b)

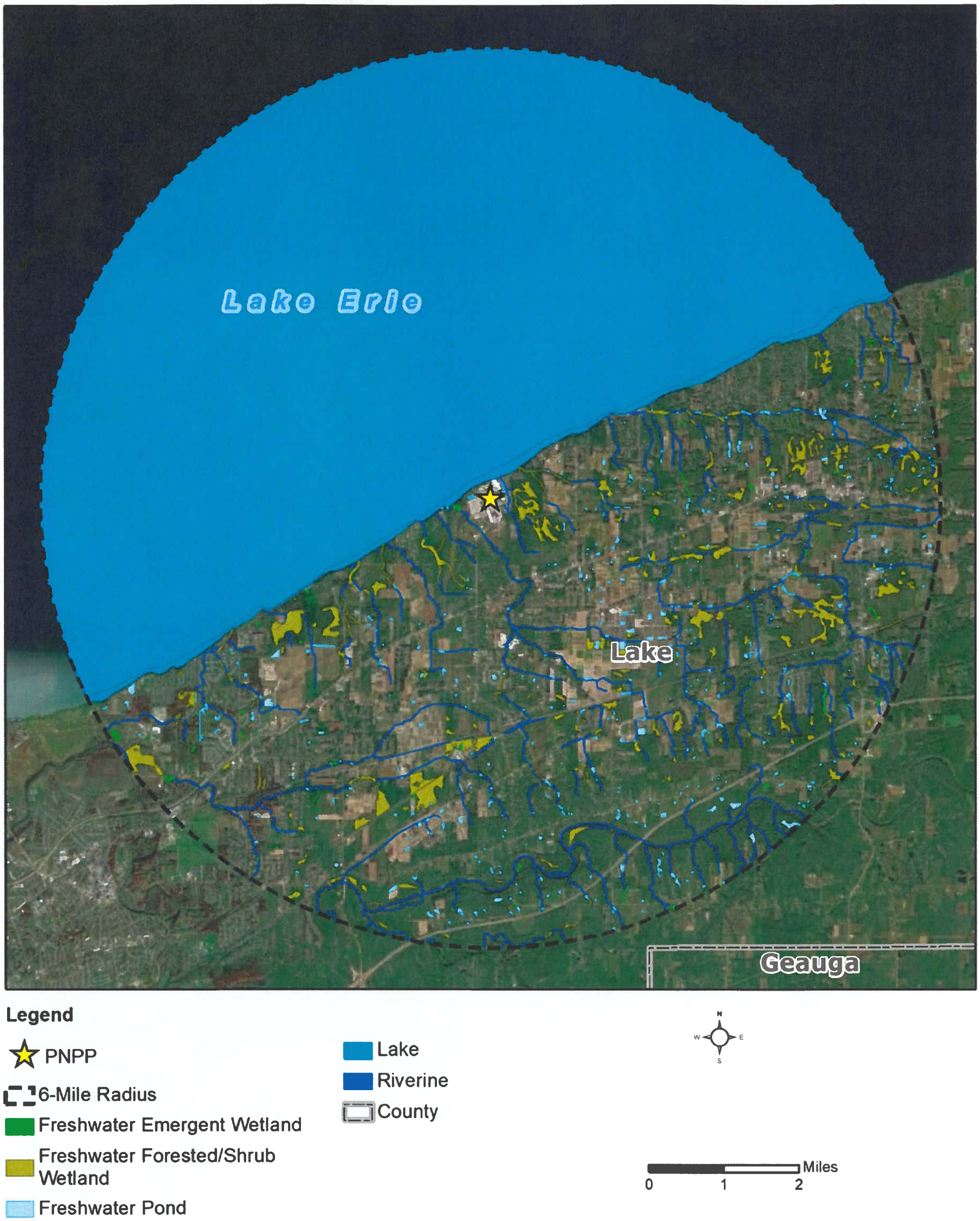


Figure 3.7-1 NWI Wetlands 6-Mile Radius

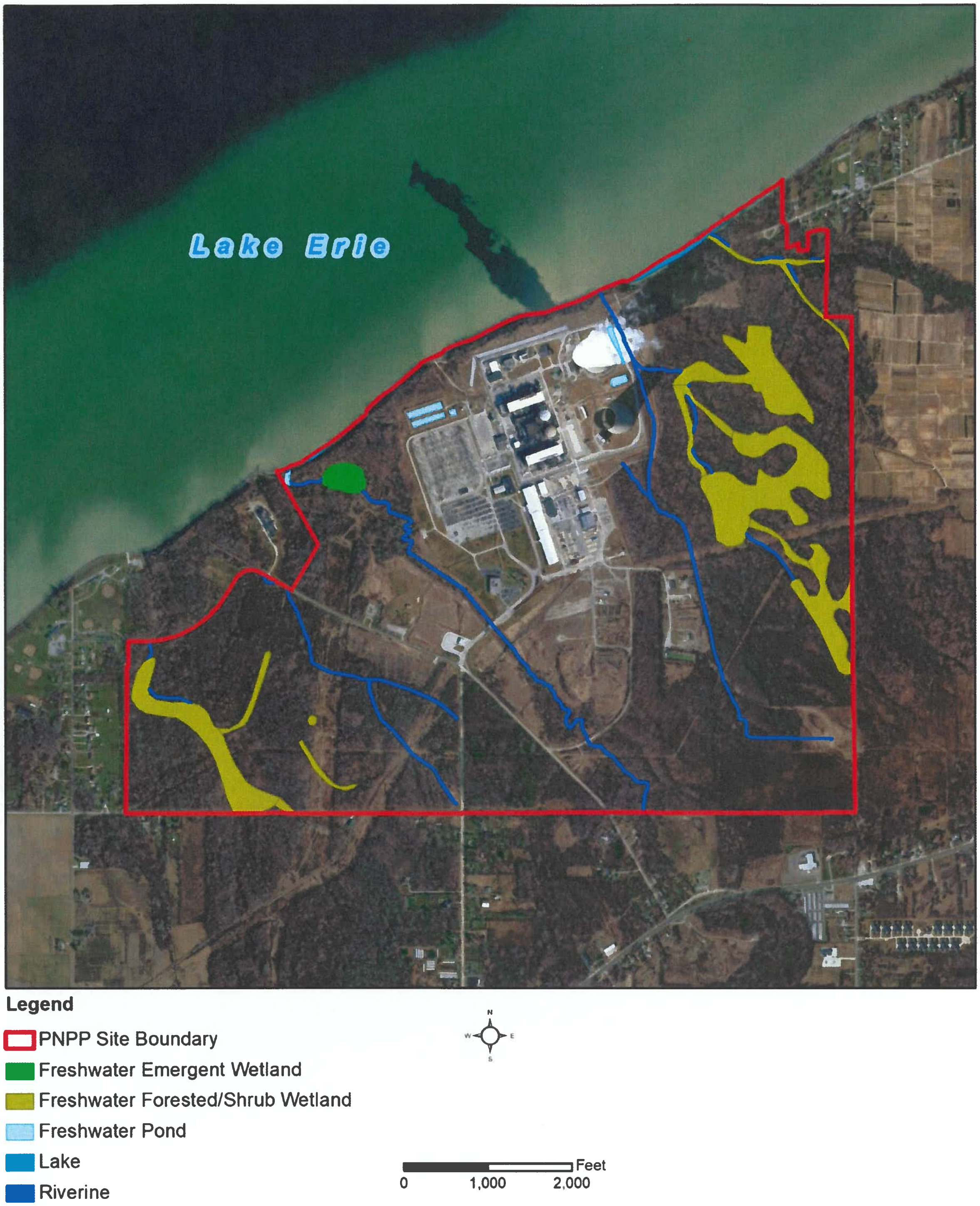


Figure 3.7-2 NWI Wetlands Onsite Map

3.8 Historic and Cultural Resources

Cultural resources include prehistoric era and historic era archaeological sites and objects, architectural properties and districts, and traditional cultural properties, which are defined as significant objects or places important to Native American tribes for maintaining their culture (USDOI 1998). Of particular concern are those cultural resources that may be considered eligible for listing on the National Register of Historic Places (NRHP). Any cultural resources listed on or eligible for the NRHP are considered historic properties under the National Historic Preservation Act of 1966 (NHPA) [Public Law 89-675].

Prior to taking any action to implement an undertaking, Section 106 of the NHPA requires the NRC as a federal agency to do the following:

- Take into account the effects of an undertaking (including issuance of a license) on historic properties, including any district, site, building, structure, or object included in or eligible for inclusion in the NRHP.
- Afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertaking.

To provide early consultation for the Section 106 process, Energy Harbor contacted the Ohio State Historic Preservation Office at the Ohio History Connection for informal consultation concerning the PNPP LRA and potential effects on cultural resources within the approximately 1,030-acre PNPP site and on historic properties within a 6-mile radius of PNPP. Native American groups recognized as potential stakeholders were also consulted by Energy Harbor with the opportunity for comment. Energy Harbor correspondence is included in Attachment D.

This ER identifies all known archaeological sites within a 6-mile radius of PNPP, as well as properties listed on the NRHP within that same radius. The approximately 1,030-acre PNPP property is described in Section 3.2. For the purpose of the LRA ER, the aboveground area of potential effects (APE) is defined as the entire PNPP property and everything within a 6-mile radius of PNPP. The aboveground APE considers the visual integrity of historical properties in relation to continued PNPP operation. The archaeological APE is considered bounded by the approximately 1,030 acres, where ground disturbance, though unanticipated during the license renewal PEO, might compromise the physical integrity of archaeological data.

No ground disturbance associated with PNPP is considered within the scope of the 10 CFR 51 evaluation. As such, the LRA consists of an administrative action relative to historic and cultural resources. Although construction of the existing PNPP facility would have impacted any archaeological resources that may have been located within their respective footprints, much of the surrounding area remains largely undisturbed. There has been one previous cultural resources survey within the 1,030-acre PNPP property and extending out from the property (Table 3.8-1).

The literature review of previously recorded cultural sites included the area within a 6-mile radius of PNPP. A record review was conducted at the Online Mapping System of the Ohio History Connection (OMS-OHC). The purpose of the literature review was to help develop an understanding of the local context by conducting an inventory of all previously and newly recorded archaeological sites on the approximately 1,030-acre PNPP property and within a 6-mile radius of PNPP, regardless of NRHP status. The PNPP site and the 6-mile radius are depicted on Figure 3.1-2.

The results of the literature review showed that there are 193 cultural resources previously recorded within 6 miles of PNPP. (OHC 2022a; OHC 2022b) Of these 193 cultural resources, 21 are cemeteries protected by State Burial Law, 37 resources are NRHP listed, and two resources have been determined eligible for the NRHP by the State Historic Preservation Officer (SHPO). There are 64 archaeological sites, one of which is listed on the NRHP, and one which has been determined eligible for the NRHP. (Tables 3.8-1, 3.8-2, 3.8-3, and 3.8-4)

3.8.1 Land Use History

The land use history for PNPP and the surrounding region was developed as part of a Phase 2A literature review and archaeological sensitivity assessment of the PNPP property and is summarized here. Section 3.8.2 provides a more detailed discussion of historical land use as part of the cultural history. Early maps provide information on how the area was used in the past. The 1868 map shows the region served by several roads and the railroad south of the plant location connecting Madison and Painesville with the greater regions (Figure 3.8-1). The composite USGS 1905 Perry, Ohio and 1904 Chardon, Ohio quadrangle topo maps shows the project area of potential effect (APE) with the North Ridge Road passing just south of PNPP connecting the communities of North Madison and Painesville (Figure 3.8-2). The composite Figure 3.8-3 USGS map depicts the 35 non-address restricted NRHP properties, one NRHP district, and the 21 recorded cemeteries within the 6-mile radius along with the modern infrastructure in the vicinity PNPP circa 1994 (Figure 3.8-3).

Photographs taken prior to, during, and after the construction of the PNPP facility are useful in showing the environmental context during that time period. As the earlier USGS maps discussed above, at the time of construction the PNPP facility and reservoir area consisted of undeveloped forest, nursery land, and agricultural fields. At the construction site the trees and brush were removed, and the area was mechanically leveled (Figure 3.8-4 and 3.8-5). Construction included excavation for the PNPP facility components (Figure 3.8-4, 3.8-5, 3.8-6, and 3.8-7). Construction of the PNPP facility included multiple buildings, structures, and parking lots (Figures 3.8-8 and 3.8-9). A general overview of the PNPP facility on the south shore of Lake Erie at the conclusion of construction in 1984 is presented in Figure 3.8-10.

The PNPP property and the surrounding region hold evidence of both prehistoric and historic occupation by Native Americans and Euro-Americans. Archaeological records suggest that the PNPP property and the surrounding area were potentially occupied by Native American populations during the Paleoindian Period (Prior to 8,000 BC) the Archaic Period (ca. 8,000 to

800 BC), the Woodland Period (ca. 800 BC to AD 900), Late Prehistoric Period (ca. AD 900 to 1650), and the Historic Period (ca. AD 1650 to present).

3.8.2 Cultural History

3.8.2.1 Paleoindian Period (13,000 to 8,000 BC)

The Paleoindian period is the earliest substantiated cultural adaptation in the Americas and Ohio. (Redmond 2006) Paleoindian peoples have been defined as nomadic big game hunters who lived in small bands which traveled seasonally within set territories for food sources that included hunting megafauna. However, this definition is not adequate in light of the observed material culture and the lack of direct evidence of subsistence practices observed in the material culture at many Paleoindian sites. Dozens of Paleoindian sites have been found in northeast Ohio. Unfortunately, the context of many Paleoindian artifact finds is often plowed out, leaving only scatters of fluted points, scrapers, and other lithic tools of exotic, or non-Ohio based chert, such as Wyandotte chert from Indiana. Many of these Paleoindian sites are known from the plowed bluffs lining the Black, Vermilion, and upper Tuscarawas rivers. (Brose 2022) At the Paleo Crossing and Noble Pond sites in Ohio, the subsistence strategy is inferred based on the large size of the stone tools. The prominent game species in the region at the time would have included caribou and possibly mammoth or mastodon. (Redmond 2006) The Sheridan Cave site in Wyandot County, Ohio presents some more definitive evidence as Paleoindian artifacts, including a large scraper, and two large bone spear points were found alongside the remains of flat-headed peccary, stag-moose, giant beaver, and giant short-faced bear (Redmond 2006). The Paleoindian tool kit and possibly their very nomadic hunting and lifeways transitioned from Paleoindian to the Archaic Period coinciding with the end of the Ice Age by 10,000 years ago (Redmond 2006).

3.8.2.2 Archaic (8,000 to 800 BC)

The Archaic Period is marked by changes in subsistence and settlement patterns likely associated with changes in climate and resulting environmental change. Warmer and dryer conditions and a rise in Lake Erie, as well as changing patterns of the rivers systems flowing into Lake Erie mark rapid and significant change in the climate and ecology of the region. (Brose 2022) This period is divided into the Early, Middle, and Late Archaic and is characterized by the exploitation of a larger variety of plant and animal resources with an overall greater diversity in material culture.

The transition to the Early Archaic Period approximately 10,000 years ago and is inferred to include a less mobile and more localized lifestyle than the preceding Paleoindian Period. Projectile points no longer exemplified the intricate work characteristic of Paleoindian tools. Early Archaic tools such as spear points, large knives, drills, scrapers, and gravers were still used, but varied in size and shape and were often fashioned with side or corner notches for hafting. (Brose 2022) While some researchers comment on the utilization of cherts of inferior quality than those prominent in the preceding Paleoindian Period (Brose 2022), others note that many of the new Early Archaic tools continue to be manufactured from the same high-quality cherts utilized previously and see it as an indication the continuation of the previous long distance travel habit by some Early Archaic populations. (Redmond 2006)

Between 7000 to 6500 years ago northeast Ohio population density increased, and there are indications of regional territories and a corresponding intensive knowledge and utilization of the natural resource base by family sized groups moving seasonally to take advantage of the regional natural resources. (Brose 2022) Groundstone tools were added to the toolkit to process plant foods such as nuts, seeds, and tubers. Distinctive grooved axes and other woodworking tools, such as adzes were added to this Middle Archaic toolkit, and were probably utilized to construct dugout canoes, and wood framed dwellings. Another marker of the Middle Archaic, the atlatl, is indicated by the bannerstone weights utilized on these spear throwing devices, even though the actual atlatls have not been found in northeastern Ohio. (Redmond 2006)

During the Late Archaic Period, 5000 and 3000 years ago, the beech-maple forests common today began to dominate the region. The Late Archaic populations settled-in to these environs, and rapid population density increase is indicated by a dramatic increase in stone grinding implements, projectile points, knives, drills, scrapers, and flake tools. The increase in the numbers and presence of bone fishhooks, harpoon heads and stone net weights indicates an increasing utilization of riverine and Lake Erie aquatic resources as well. (Redmond 2006) One author notes that the Late Archaic sites reveal the first unambiguous evidence of regionally specific seasonal territoriality, limited gardening of squash and several native plant seeds, and long-distance trade based on both raw materials and finished artifacts made from nonlocal materials. These exotic goods were often found in single graves and are inferred to be markers of status. (Brose 2022)

3.8.2.3 Woodland (800 BC to 900 AD)

The Early Woodland Period in northeast Ohio correlates with the technological innovation of stone (steatite) cooking vessels and thick fragments of the first pottery in the region. The steatite vessels were most likely imported from Maryland or Pennsylvania, while the pottery is manufactured from riverine clay tempered with crushed granite derived locally. The cord marks and other impressions on the pottery also bear witness to a fairly sophisticated, cordage, mat, and basket industry of the northeast Ohio Early Woodland Period. (Redmond 2006) An increase in the frequency of charred seed, squash, pumpkin, and some maize suggest the beginnings of village horticulture. The Early Woodland (800-100 BC) and Middle Woodland (100 BC-AD 500) periods have been characterized by an increase elaboration in both ceremonial exchange and the mortuary rituals from the preceding Late Archaic. Earthen mounds sites are the most common and visual remains of this activity. Known mounds are most often located on high bluffs or on terraces overlooking major waterways, but these locations could also be the result of site preservation dynamics. (Brose 2022) By the middle of the Woodland period, about 2000 years ago, large campsites and small villages were established. These settlements were often occupied for several months duration and appear on high steep sided ridges along the Grand, Cuyahoga, Vermillion and Black rivers and larger creeks, often at locations reasoned to be defensible. Due to the locations of the settlements, early antiquarians often called these settlements Indian "forts." Several of the locations even had low earthen walls and ditches which resemble fortifications. (Redmond 2006) Excavations at many of these sites found few artifacts or evidence of extended settlement, while at others, evidence of dwellings, pits, and middens with Woodland pottery, stemmed projectile points, and bone tools were prevalent. (Redmond 2006)

Some of these hilltop enclosure sites did have low mounds and many of the sites have Adena artifacts. Further, although sites with artifacts attributed to the Hopewellian culture are found in northeast Ohio, the phenomenon of large elaborate earthworks and multiple burial mounds is not known outside southern Ohio. (Redmond 2006) Many of the middle to late Woodland sites in northeast Ohio which do not have mounds which have been excavated indicate that inhabitants of the region continued to carry on a localized traditional hunting, gathering, and fishing lifeway without much participation in the Hopewellian exchange network or elaborate ceremonialism. (Redmond 2006)

Late Woodland (AD 500-900) period is characterized by a mild climate, and at archaeological sites from the period there are few differences in the size or composition of these sites. Instead, the sites appear to have been occupied at different seasons and for different purposes. Although there are no permanent agricultural villages, corn and squash cultigens are present at many sites occupied during the late summer. Features present include small circular houses with one or two hearths and a few shallow storage pits. Sites occupied in the spring include large village fishing and plant gathering camps on lake shore ridges, shores, and at the headwaters to large creeks and tributaries to major rivers. (Brose 2022) About 1,000 years ago, prior to the end of the Woodland period the transition from larger dart points to smaller, thinner finely notched and unnotched triangular points occurs. (Redmond 2006)

3.8.2.4 Late Prehistoric (900 AD to 1650)

The native populations of northeast Ohio began to aggregate into semi-permanent settlements along every major river valley draining into Lake Erie. The villages' locations often housed dozens of families and were occupied at least from spring to early fall, and often year-round by 800 years ago. This Late Prehistoric population is known as the Whittlesey cultural tradition, named for the 19th century antiquarian Charles Whittlesey. (Redmond 2006) The villages have both round and rectangular house patterns, with fire pits. Storage pits are often deep and large, and often contain distinctively decorated pottery, triangular arrow points and other refuse. Maize, beans, and squash indicate the first fully agricultural society in the region, while bones from birds, mammals and fish are indicative that traditional wild foods continued in importance after the adaption of maize agriculture. (Redmond 2006)

The location of many Whittlesey Tradition sites has remnants of wooden stockades, ditches, and other identifiable defensive works. Additionally, many of the burials contain embedded chert arrowpoints or evidence of violence. Many of the sites are found on defendable landforms on well drained sandy glacial beach remnant ridges offering farmable soils, with associated springs. Hence these locations offer a self-contained defendable location, along traditional trail systems, with access to farmable soils. By 350 years ago the last groups of the Whittlesey tradition had abandoned northeast Ohio. (Redmond 2006) Brose and many other authors have more detailed discussions of the late prehistoric population demise in northeast Ohio (Brose 2022). What is known, is that the earliest historical accounts in 1650 noted that northern Ohio was "devoid of native inhabitants and serves as primarily the 'war road' for Iroquoian invaders." (Redmond 2006)

3.8.2.5 Historic Period (1650 AD to Present)

Early historic Period to Statehood: 1650-1803 (Dates summarized from The Timeline of Ohio History). (OHC 2022a) Throughout the 1600s and 1700s the ownership of Ohio Country, consisting of modern-day Ohio, western Pennsylvania, northwestern West Virginia, and eastern Indiana, was claimed by both the French and the British. (OHC 2022b) During this period the Erie Nation occupied the land south of Lake Erie. During the Beaver Wars, beginning in 1640 the Iroquois Confederacy began a campaign for the control of the fur trade in the great lakes region after depleting much of the game in their homeland on the St. Lawrence River. (OHC 2022c) As a result of the conflict the Erie Nation was annihilated or assimilated into other groups outside of the region. (ECH 2022) The 1701 Treaty of Grande Paix, or Great Peace between the Iroquois Confederacy, the French, and British ended the Beaver Wars. However, the conflicts between Native Americans, the French, Dutch, and British for control of the interior continued for decades. (OHC 2022c) Northwestern Ohio may have not been occupied by any tribes, but the region was the hunting grounds of the Iroquois and subjugated tribes such as the Lenape, Delaware, and Wyandotte. By the mid-1700s the presence of both French and British traders in the region led to the French and Indian wars which concluded in the Treaty of Paris in 1763. Another result of the war was the Proclamation of 1763 which prohibited colonists from living west of the Appalachian Mountains. Adding further fuel to the American Colonists grievances which would lead up to the Revolutionary War. (OHC 2022b)

Following the Revolutionary war, the United States claimed the unsettled western Lands. A claim justified by the reasoning that these lands were a part of the colonies. The United States congress lobbied states to give up their claims to these western lands in the mid-1780s and all states with the exception of Connecticut complied in order to complete the formation of the Northwest Territory. Connecticut continued to make claim on a 120-mile-long tract, west of Pennsylvania which became known as the Connecticut Western Reserve, which was divided into a western portion and an eastern portion. The western portion of the tract was known as the Fire Lands and was given to those who suffered the loss of property in the Revolutionary War. The eastern portion was sold to the Connecticut Land Company in 1795. General Moses Cleaveland was sent to survey the new territory. His townships consisted of 25 square miles, rather than the standard 36 square mile townships common to most federal surveys. One of the earliest towns in the region was named Cleveland in honor of General Moses Cleaveland. (OHC 2022d)

Early Statehood 1803-1846: At the time of statehood in 1803 the PNPP property was located in Trumbull County which occupied the northeast corner of Ohio. In 1805 the State Legislature created Geauga County which included Plymouth Township. In 1815 Plymouth Township was divided into Painesville and Perry Townships. Then in 1840 Lake County was formed from six townships from Geauga County and one township from Cuyahoga County. (NPV 2022c) Although the name and size of the county was not settled until 1840, new settlers began arriving the immediate region in the early 1800s. Among the earliest settlers in the region were Samuel and Hannah Huntington who reportedly arrived in 1808. (LCHC 2022) Samuel Huntington served as governor of Ohio from 1808 to 1810. Eleazar Parmly and his wife Hanna Spear established a pioneer home in the area of North Perry by 1817, following their married daughters Hanna Burridge, who arrived in 1814, and her sister Betsey Hurlbert who arrived in 1816. Jahial Parmly, one of Hanna and Betsey's four brothers, established a flour mill called The Red Mill in 1840 on North Ridge Road, which some records indicate was the first major industry the region. (NPV 2022c)

By this time in the 1840s the region had changed from the earlier decades of the 1800s. Transportation had improved, cabin industries had increased, additional mills and industries such as Arcole Furnace Company was constructed in Lake County. The Mormon Temple was completed in 1834 in Kirkland, although most of the followers of that faith, left Ohio later in the 1800s. Architect Johnathon Goldsmith designed Greek Revival homes paved the way for the estate era and soon an InterUrban railroad was introduced in the county. Painesville was the county seat, water transportation was available at Fairport Harbor, stage service to both Buffalo and Detroit was available to the county. (LCHC 2022) Although Lake County is the state's smallest county with only 228 land acres, by the 1850s the county was growing and prospering.

The latter half of the 19th century continued to bring new industry to Lake County. Agriculture has always been a predominant industry in the region. Orchards, vineyards, and row crops flourished in this era. The county was once hailed as the Onion Capital of the world until blight ravaged that crop, forcing a new direction in the region's agricultural activity. The first plant nursery was formed in 1861 in Perry Township (NPV 2022c). Changes were occurring in other industries in the region as well. By 1880 the harbor was slowing down at Fairport as the equipment aged and new railroads increased their role in the region's transportation. However, discoveries of iron ore in Michigan revitalized the entire transportation sector, and new docks were built at Fairport Harbor, and old rail lines were rebuilt throughout the region. Labor shortages led to an influx of European immigrants to fill the available jobs in the region, leading to population growth. (LCHC 2022)

At the turn of the 20th century estate building and summer homes on the shore of Lake Erie was a burgeoning area of economic growth. The presence of an InterUrban line in Lake County allowed the wealthy to reside seasonally, or year-round in Lake County, and still take advantage of the metropolitan Cleveland culture and commercial sector one hour away. (LCHC 2022) The overall character of the county continued to be agricultural, and the burgeoning nursery industry continued to provide some jobs even during World War I, the great depression, and World War II. During the depression WPA projects in the region included the installation of clay tile drainage systems to improve the agricultural production of the region (NPV 2022c) After World War II automobiles and GI Loans lead to suburban development east of Cleveland in the western portion of the county. (LCHC 2022) The county history notes that the counties first 50 years and last 50 years may have been its most dramatic. While the western end of the county has historically been tied to the Cleveland metropolitan area and the manufacturing and jobs present in that region, just as the eastern end of the county has been tied to the nursery industry over the last 100 years. At this time Lake County is rated third in the world for nursery production. (LCHC 2022) Construction on PNPP Unit 1 began in 1974 and went online November 13, 1986, adding substantial economic impact to the county. The property taxes from the power plant created substantial benefit to the Perry Schools district, the villages of Perry and North Perry, and Perry Township. (NPV 2022c)

3.8.3 Onsite Cultural Resources

Onsite cultural resources are those located within the approximately 1,030-acre site on Lake Erie PNPP property. That property includes the entirety of the archaeological APE, which is also the onsite portion of the aboveground APE. A review of the OMS-OHC revealed that there are no cultural resources listed within the approximately 1,030-acre PNPP site. No NRHP-eligible cultural resources have been recorded within the approximately 1,030-acre PNPP site and no structures within the PNPP property have been documented through the Historic American Buildings Survey or Historic American Engineering Record programs.

3.8.4 Offsite Cultural Resources

Offsite cultural resources are those outside the PNPP property boundary. There are 193 offsite resources within 6 miles of the PNPP. Lists of the known archaeological sites, Determination of Eligibility (DOE) locations, historic structures, cemeteries, and NRHP listed properties within a 6-mile radius of PNPP are presented in Tables 3.8-1, 3.8-2, 3.8-3 and 3.8-4. The OMS lists 64 archaeological sites, two DOE listed locations, 100 historic structures, 21 cemeteries, and 37 NRHP properties within 6 miles of the PNPP site. (OMS-OHC 2022) The total number of resources is skewed by the fact that some resources are listed more than once on the OMS-OHC data sets. Table 3.8-1 for address restricted archaeological sites and DOE listed resources has 65 entries, as site LA0158 is also listed as DOE 3926. Table 3.8-2 for historic structures has 100 properties, of which 29 entries are also listed on the NRHP. The 29 historic structure entries with dual NRHP Property entries listed in Table 3.8-2 under the Ohio Historic Inventory (OHI) numbers with a superscript[b] to note the dual listing on both tables. Table 3.2-3 for the 21 cemeteries has no dually listed entries. Table 3.2-4 lists 37 NRHP properties, of which one is a restricted archaeological site (LA0002). Hence, although there are 224 resources listed in the OMS-OHC data sets, the actual number of individual resources within 6 miles of PNPP totals 193. The locations of the 36 unrestricted NRHP properties and 21 cemeteries are presented on Figure 3.8-3.

The closest DOE listed resource, DOE 2352, is located 1.16 miles from the PNPP Unit 1. There is limited information on the DOE 2352 data set, beyond the fact that it is a cobblestone outbuilding which is considered eligible. The close proximity of DOE 2352 to PNPP increases the chances for noise and visibility impacts at this property. The viewshed mode available on

Google Earth from the street directly in front of DOE 2352 clearly shows that the Unit 1 plume and the top of the Unit 2 cooling tower 2 are visible from the structure. Additionally, the Unit 2 cooling tower is completely visible from the street in front of the entire property the cobblestone outbuilding is located at. The closest NRHP property, 76001462 the Lucius and Corrilla Green House is located 2.9 miles from the PHPP site. The combination of the distance, topography and vegetation limit the visual and noise impacts to the 76001462 property. The remaining 36 NRHP properties are all over 3.7 miles from the PNPP site. Therefore, any visual or noise related impacts to these 37 NRHP properties would be minimal due to distance, topographic variability, and vegetation.

3.8.5 Cultural Resource Surveys

There has been one previous cultural resources survey within the approximately 1,030-acre PNPP site and immediate vicinity. The cultural resources survey investigation consisted of a survey of 160 acres of the proposed PNPP site in the late spring of 1973. The survey resulted in the recording of two sites, LA0137 and LA0138. No further work was recommended at the two archaeological sites in 1973. (Brose and Lee 1975) The location of the two sites is not within the approximately 1,030-acre PNPP site boundary. No additional cultural resources surveys have been conducted within the approximately 1,030-acre PNPP site. There have been 12 Phase I Cultural resources surveys and two Phase II cultural resources investigations documented outside of the approximately 1,030-acre PNPP site, but within 6 miles of the PNPP property.

3.8.6 Procedures and Integrated Cultural Resources Management Plans

As discussed in Section 2.3, no refurbishment activities are planned at PNPP during the license renewal term. PNPP has procedures to protect previously unknown historic or cultural resources that may be discovered on the site. Energy Harbor is not aware of any historic or archaeological resources that have been affected by PNPP operations, as no previously recorded cultural resources are located on PNPP property. PNPP has two procedures which aim to identify, protect, and minimize the potential of impact to cultural resources within the PNPP facility, which are NOP-WM-40007 Excavation and Trenching Controls, and NOP-OP-2010 Environmental Evaluations Resources procedures. The procedures state that activities governed by the Excavation Controls Procedure shall be planned and implemented by use of the Excavation Permit, NOP-WM-4007-01. These procedures define Archaeological, Cultural and Historical (AC&H) resources, and are designed to protect against the impacts to properties, sites, and unanticipated discoveries of AC&H resources. The procedures outline the stop work process and additional steps required if an unanticipated discovery of an AC&H resource is encountered during any ground disturbing activities.

Table 3.8-1 Archaeological Sites and DOE Listings within 6 Miles of PNPP (Sheet 1 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0002 NRHP#74001543	Painesville	Prehistoric to Historic period fort	Listed on the NRHP 74001543
LA0003	Painesville	Painesville Village site with unknown Woodland components excavated in 1934	Unassessed
LA0019	Painesville	Unassigned prehistoric lithic scatter (N=16)	Unassessed
LA0020	Perry	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0021	Painesville	Unassigned Prehistoric site based on the reported location of projectile points finds	Unassessed
LA0022	Painesville	Unassigned prehistoric lithic scatter (N=5)	Unassessed Reported destroyed
LA0023	Painesville	Unassigned Archaic site	Unassessed
LA0024	Painesville	Unassigned prehistoric lithic scatter (N=5)	Unassessed Reported destroyed
LA0032	Thompson	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0033	Madison	Unassigned prehistoric lithic scatter (N=8)	Unassessed
LA0034	Thompson	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0035	Thompson	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0043	Madison	Early Woodland Adena point	Unassessed
LA0044	Madison	Isolated find of an unassigned Archaic projectile point	Unassessed
LA0046	Madison	Multicomponent artifact collection with diagnostics from the unknown, Late Archaic, and Early and Late Woodland Periods	Unassessed
LA0055	Madison	Late Archaic artifact collection	Unassessed

Table 3.8-1 Archaeological Sites and DOE Listings within 6 Miles of PNPP (Sheet 2 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0059	Perry	Unassigned prehistoric site with an unknown Archaic lithic point	Unassessed
LA0060	Perry	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0061	Perry	Unassigned prehistoric lithic scatter (N=9)	Unassessed
LA0062	Perry	Unassigned prehistoric lithic scatter (N=30)	Unassessed
LA0064	Perry	Multicomponent artifact collection with diagnostics from the Paleoindian, Early to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0065	Madison	Multicomponent artifact collection with diagnostics from the Paleoindian, Early to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0066	Madison	Multicomponent artifact collection with diagnostics from the Late Woodland Period	Unassessed
LA0077	Madison	Multicomponent artifact collection with diagnostics from the Paleoindian, Middle to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0078	Madison	Multicomponent artifact collection with diagnostic from the, Unknown, Early & Late Archaic, and unknown, Early & Late Woodland Periods	Unassessed
LA0080	Madison	W. T. Baster Family 19th century graveyard	Protected by State burial laws

Table 3.8-1 Archaeological Sites and DOE Listings within 6 Miles of PNPP (Sheet 3 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0095	Painesville	Lithic scatter with an Early Woodland point (N=51)	Unassessed
LA0096	Painesville	Unassigned prehistoric lithic scatter (N=19)	Unassessed
LA0097	Madison	Multicomponent site with unassigned prehistoric lithic scatter (N=7) and two fragments of smelting glass	Unassessed
LA0098	Madison	Unassigned prehistoric lithic scatter (N=11)	Unassessed
LA0099	Perry	Unassigned prehistoric lithic scatter (N=5)	Unassessed
LA0100	Perry	Unassigned prehistoric lithic scatter (N=5)	Unassessed
LA0113	Painesville	An unassigned prehistoric cemetery where 23 graves were reportedly removed	Reported destroyed, Unassessed
LA0122	Perry	Late Woodland lithic scatter (N=32)	Unassessed
LA0123	Perry	Unassigned prehistoric lithic scatter with an unknown Archaic point (N=14)	Unassessed
LA0129	Madison	Unassigned prehistoric lithic scatter (N=18)	Unassessed
LA0130	Madison	Unassigned prehistoric lithic scatter (N=18)	Unassessed
LA0137	Perry	Middle Archaic lithic scatter with a St. Albans bifurcate point, debitage, two incomplete bifaces, one flake scraper, and 3 deer bone fragments (tested)	Unassessed Noted as destroyed
LA0138	Perry	Unassigned prehistoric lithic scatter (items not listed), tested	Unassessed No further work recommended

Table 3.8-1 Archaeological Sites and DOE Listings within 6 Miles of PNPP (Sheet 4 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0158[a]	Painesville	Multicomponent 1810-1840 cabin site/Late Woodland Village site with features	Recommended potentially eligible, criteria D 1991, DOE 3926
LA0160	Perry	Late Woodland site with fire pits, a house feature, pottery, animal bone, lithic tools, debitage, and floral remains N=4,221	Unassessed
LA0165	Painesville	The reported location of a Late Woodland to Late Prehistoric cemetery	Unassessed
LA0170	Painesville	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0171	Perry	19th to early 20th century farmstead with two foundations, a barn and scatter of domestic refuse (N=9)	Unassessed
LA0172	Perry	19th to 20th century domestic debris scatter (N=7)	Unassessed
LA0173	Perry	19th to 20th century domestic debris scatter (N=19)	Unassessed
LA0174	Perry	19th to 20th century domestic debris scatter (N=8)	Unassessed (Removed from State Registry)
LA0175	Perry	Unassigned prehistoric lithic scatter (N=5) and the Possible 1854 Parmely Family Cemetery	Prehistoric unassessed 19th century cemetery is protected by State burial laws
LA0176	Perry	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0177	Perry	Unassigned prehistoric lithic scatter (N=1)	Unassessed
LA0181	Madison	19th to 20th century domestic debris scatter from a farmstead	Unassessed

Table 3.8-1 Archaeological Sites and DOE Listings within 6 Miles of PNPP (Sheet 5 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0182	Madison	A mid-20th century concrete capped water well	Unassessed
LA0183	Madison	Unassigned lithic scatter with an unknown Woodland ceramic sherd (N=80)	Unassessed
LA0184	Madison	Unassigned non-aboriginal surface domestic trash scatter	Unassessed
LA0185	Madison	Non-aboriginal surface domestic refuse scatter circa 1880 to 1929	Unassessed
LA0196	Painesville	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0197	Painesville	Isolated find of a single flake	Unassessed
LA0219	Offshore	ESCO#Allegheny/King Coal shipwreck 1970	"No National Register potential"
LA0220	Offshore	Red Bird shipwreck from prior to 1903	"No National Register potential"
LA0221	Offshore	Charles B. Hill/Delaware shipwreck	"No National Register potential"
LA0225	Perry	Mid-20th century refuse and architectural debris scatter (N=8)	Unassessed
LA0226	Perry	1930 to 1960 surface scatter of domestic refuse (N=8)	Unassessed
LA0227	Perry	Two solarized glass vessel fragments with a manufacture date from 1870 to 1914	Unassessed No further work recommended
LA0228	Perry	Isolated find of a Late Archaic projectile point base	Unassessed
DOE 2352[a]		Cobblestone House	Determined eligible

a. DOE listed.

Table 3.8-2 Historic Structures Entries within 6 Miles of PNPP (Sheet 1 of 4)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0000407[b]	Dr. J. C. Winan House	Single Dwelling	Eastlake	5.3 miles
LAK0000506	J. Mcvitty House	Single Dwelling	Queen Anne	2.9 miles
LAK0000606	A. Becker House	Single Dwelling	Greek Revival	4.1 miles
LAK0000706	R. E. Allison House	Single Dwelling	Greek Revival	4.9 miles
LAK0000806	Green & Hoose Cold Storage	Warehouse	Vernacular	2.9 miles
LAK0001006	Depot	Rail Related	Vernacular	3.2 miles
LAK0001107	Dist. School #12 & High School	School	Second Renaissance Revival	5.0 miles
LAK0001206	J. Gibbs House	Single Dwelling	Vernacular	3.8 miles
LAK0004307[b]	Addison Kimball House	Singe Dwelling	Federal	5.0 miles
LAK0004407[b]	William Lyman House	Single Dwelling	Vernacular	4.6 miles
LAK0004507[b]	Francis Ensign Fuller House	Single Dwelling	Italianate	4.6 miles
LAK0004607[b]	James Dayton House	Single Dwelling	Vernacular	4.5 miles
LAK0004707[b]	George Damon House	Single Dwelling	Greek Revival	4.6 miles
LAK0004807[b]	George Pease House	Single Dwelling	Greek Revival	4.8 miles
LAK0004907[b]	Lemuel Kimball II House	Single Dwelling	Italianate	4.9 miles
LAK0005007[b]	Albert DeHeck House	Single Dwelling	Stick	4.9 miles
LAK0005107[b]	James Dayton House II	Single Dwelling	Second Empire/Mansard	5.0 miles
LAK0005207[b]	Solomon Kimball House	Single Dwelling	Vernacular	5.0 miles
LAK0005307[b]	Alpha Charles Childs House	Single Dwelling	Italianate	5.1 miles
LAK0005407[b]	Robertus Childs House	Single Dwelling	Federal	5.1 miles
LAK0005507[b]	Edwin Ware House	Single Dwelling	Federal	5.1 miles
LAK0005607[b]	Rev Harlan Metcalf House	Single Dwelling	Italianate	5.1 miles
LAK0005707[b]	Cyrus J. Ingersoll House	Single Dwelling	Greek Revival	5.11 miles
LAK0005807[b]	Francis Hendry House	Single Dwelling	Italianate	5.1 miles

Table 3.8-2 Historic Structures Entries within 6 Miles of PNPP (Sheet 2 of 4)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0005907[b]	Jane Gilbert House	Single Dwelling	Vernacular	5.2 miles
LAK0006007[b]	H. Gill House	Single Dwelling	Italianate	5.4 miles
LAK0006107[b]	Joseph Talcott House	Single Dwelling	Federal	5.5 miles
LAK0006207[b]	George D. Wilson House	Single Dwelling	Greek Revival	5.5 miles
LAK0006407[b]	John Kellogg House & Barn	Single Dwelling	Greek Revival	5.4 miles
LAK0006507[b]	David Smead House	Single Dwelling	Italianate	5.6 miles
LAK0006607[b]	Charles Gilbreath House	Single Dwelling	Vernacular	5.3 miles
LAK0006707[b]	Selby Orland House	Single Dwelling	Federal	5.9 miles
LAK0006807[b]	N/A	Single Dwelling	Vernacular	5.3 miles
LAK0006907[b]	NY Chicago & St. Louis Freight	Rail Related	Eastlake	5.3 miles
LAK0007007[b]	John J. Jones House	Single Dwelling	Italianate	5.2 miles
LAK0007107[b]	Cheese-vat Factory	Mill/Processing/ Manufacturing Facility	Commercial Chicago Style	5.2 miles
LAK0008904	J. C. Huntington Estate	Park/Arena/ Field	Vernacular	5.2 miles
LAK0014407	W.H. Judd House	Single Dwelling	Greek Revival	4.8 miles
LAK0014607	Buehner House	Single Dwelling	Vernacular	3.3 miles
LAK0014804	Warren's Store	Service Station	Vernacular	4.7 miles
LAK0014904	Barto House	Single Dwelling	Vernacular	5.2 miles
LAK0015004	Storrs & Harrison Nursery	Single Dwelling	Vernacular	5.0 miles
LAK0015104	Frank Heckathorn House	Single Dwelling	Vernacular	4.8 miles
LAK0015204	N/A	Single Dwelling	Bungalow	4.8 miles
LAK0015304	Mary Starr House	Single Dwelling	Vernacular	4.7 miles
LAK0015404	R. Marshall House	Single Dwelling	Italianate	4.7 miles
LAK0015504	Paul Lincoln House	Single Dwelling	Vernacular	4.6 miles
LAK0015604	James Lincoln House	Single Dwelling	Craftsman/Arts and Crafts	4.6 miles

Table 3.8-2 Historic Structures Entries within 6 Miles of PNPP (Sheet 3 of 4)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0015704	N/A	Single Dwelling	Vernacular	4.6 miles
LAK0015804	N/A	Single Dwelling	Vernacular	4.5 miles
LAK0015904	J. B. Breed Dairy Farm	Barn	Vernacular	4.3 miles
LAK0016006	S. H. Hull House	Single Dwelling	Vernacular	3.4 miles
LAK0016106	Robert Castler House	Single Dwelling	Vernacular	3.1 miles
LAK0016206	G.A. Fitz House	Single Dwelling	Vernacular	3.1 miles
LAK0016306	George West House	Single Dwelling	Vernacular	2.8 miles
LAK0016406	Harry Few Farm	Single Dwelling	Vernacular	2.5 miles
LAK0016506	N/A	Single Dwelling	Vernacular	2.5 miles
LAK0016606	School No. 1	School	Vernacular	2.3 miles
LAK0016706	Coolidge House	Single Dwelling	Queen Anne	2.3 miles
LAK0016806	Barkalow Farm	Single Dwelling	Italianate	2.2 miles
LAK0016906	N/A	Single Dwelling	Vernacular	2.2 miles
LAK0017006	Stockham/Barkalow Farm	Single Dwelling	Vernacular	2.2 miles
LAK0017106	Old Tavern Farm	Single Dwelling	Vernacular	2 miles
LAK0017206	James Cook House	Single Dwelling	Vernacular	1.9 miles
LAK0017306	N/A	Single Dwelling	Craftsman/Arts and Crafts	1.8 miles
LAK0017406	Disciples Parsonage	Rectory/ Parsonage	Vernacular	1.8 miles
LAK0017506	Barkalow House	Single Dwelling	Vernacular	1.6 miles
LAK0017606	Stevens House	Single Dwelling	Vernacular	1.6 miles
LAK0017706	Lapham House	Single Dwelling	Vernacular	1.5 miles
LAK0017806	N/A	Single Dwelling	Dutch Colonial Revival	1.5 miles
LAK0017906	Ridgeway Lunch	Road/Vehicle Related	Vernacular	1.5 miles
LAK0018006	V. R. Wilcox House	Single Dwelling	Vernacular	1.4 miles
LAK0018106	Elizabeth Parks (House)	Single Dwelling	Vernacular	1.4 miles
LAK0018206	E. W. Beker House	Single Dwelling	Vernacular	1.4 miles
LAK0018306	N/A	Single Dwelling	Vernacular	1.3 miles

Table 3.8-2 Historic Structures Entries within 6 Miles of PNPP (Sheet 4 of 4)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0018406	Chapman House	Single Dwelling	Vernacular	1.2 miles
LAK0018506	Graya House	Single Dwelling	Vernacular	1.2 miles
LAK0018606	J. A. Whiting House	Single Dwelling	Greek Revival	1.2 miles
LAK0018706	Zora Bennett House	Single Dwelling	Italianate	1.2 miles
LAK0018806	Perry House	Single Dwelling	Italianate	1.2 miles
LAK0018906	Metroparks	Mill/Processing/ Manufacturing Facility	"Style not Discernable from OHI form"	1.2 miles
LAK0019006	Hurobut House	Single Dwelling	Vernacular	1.3 miles
LAK0019106	J. Whiting House	Single Dwelling	Vernacular	1.4 miles
LAK0019206	Browen Farm	Single Dwelling	Vernacular	1.5 miles
LAK0019306	L. Barkalow House	Single Dwelling	Vernacular	1.5 miles
LAK0019406	George G. Hoyt House	Single Dwelling	Greek Revival	1.6 miles
LAK0019506	Clyde Hull Farm	Single Dwelling	Vernacular	1.6 miles
LAK0019606	N/A	Single Dwelling	Vernacular	1.6 miles
LAK0019706	N/A	Single Dwelling	Craftsman/Arts and Crafts	1.6 miles
LAK0019806	N/A	Single Dwelling	Bungalow	1.6 miles
LAK0019906	Residence	Single Dwelling	Vernacular	1.6 miles
LAK0020006	A. W. Seith Farm	Single Dwelling	Vernacular	1.8 miles
LAK0020106	Seith Farm	Single Dwelling	Vernacular	1.8 miles
LAK0020206	P. Hawkins Farms	Single Dwelling	Vernacular	1.9 miles
LAK0020306	L.S. Haines House	Single Dwelling	Greek Revival	2.0 miles
LAK0031007	N/A	Single Dwelling	Italianate	3.6 miles
LAK0037607	Vanderveer Farm	Single Dwelling	Italianate	3.2 miles
LAK0038406	N/A	Single Dwelling	"No Academic Style- Vernacular	3.7 miles
LAK0038506	Tip Top Motel	Hotel/Inn/Motel	N/A	3.6 miles
LAK0038606	Limberlost Lodge/Motel	Hotel/Inn/Motel	N/A	3.7 miles

(OMS-OHC 2022)

a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.
b. NRHP listed.

Table 3.8-3 Cemeteries within 6 Miles of PNPP

OGSI ID#	Quadrangle	Site Type	NRHP Status
6311	Thompson	Northeast Leroy-Clague Farm Cemetery	Protected by State burial laws
6316	Madison	Fairview Memorial Park-Madison Village-River Street Cemetery	Protected by State burial laws
6317	Madison	Northridge-Fuller Farm Cemetery	Protected by State burial laws
6318	Madison	Middle Ridge-Genung Corners Cemetery	Protected by State burial laws
6319	Madison	North Madison Cemetery	Protected by State burial laws
6321	Madison	South Ridge-Tisdel/Antisdel-Pioneer Cemetery	Protected by State burial laws
6340	Thompson	Lemuel Ellis-River Road-Orcutt Cemetery	Protected by State burial laws
6341	Painesville	Lane Road-Perry South Ridge-South Ridge-Perry-Wright Farm Cemetery	Protected by State burial laws
6342	Perry	Parmly/Parmly-Ronke Cemetery	Protected by State burial laws
6343	Perry	Perry Township-Perry Center-Disciple-Perry Cemetery	Protected by State burial laws
6344	Perry	Narrows Road Cemetery	Protected by State burial laws
14350	Madison	Isham-Dayton Road Cemetery	Protected by State burial laws
14351	Madison	Centerville Cemetery	Protected by State burial laws
15688	Thompson	Palmer Cemetery	Protected by State burial laws
15693	Madison	First Congregational Church Cemetery	Protected by State burial laws
15694	Madison	Brewster Cemetery	Protected by State burial laws
15695	Perry	Samuel Huntington Family Cemetery	Protected by State burial laws
15697	Madison	Turneys Corners Cemetery	Protected by State burial laws
15698	Madison	W.T. Baster Family Cemetery	Protected by State burial laws
15702	Madison	Mayers Woods Cemetery	Protected by State burial laws
15703	Perry	Call Road Cemetery	Protected by State burial laws

(OMS-OHC 2022)

Table 3.8-4 NRHP Properties within 6 Miles of PNPP (Sheet 1 of 2)

Resource Name NRHP listing	County	Quadrangle	NRHP Listed	Distance from PNPP[(a)]
Lemuel Kimball (II) House 74001540	Lake	Madison	10/15/1974	4.9 miles
Indian Point Fort 74001543	Lake	Painesville	07/30/1974	4.9 miles
Addison Kimball House 75001449	Lake	Madison	03/27/1975	5.0 miles
David R. Paige House 75001450	Lake	Madison	12/23/1975	5.3 miles
Dr. J. C. Winans House 76001461	Lake	Madison	10/20/1980	5.4 miles
Lucius & Corrilla Green House 76001462	Lake	Perry	07/12/1976	2.9 miles
Ladd's Tavern 78002091	Lake	Madison	05/22/1978	3.7 miles
Madison Seminary and Home 79001871	Lake	Madison	02/29/1979	5.1 miles
Judge Abraham Tappan House 79001874	Lake	Madison	05/08/1979	4.8 miles
Brick Vernacular House No.1 80003108	Lake	Madison	10/20/1980	5.3 miles
Brick Vernacular House No. 2 80003109	Lake	Madison	10/20/1980	5.3 miles
Cheese-vat Factory 80003110	Lake	Madison	10/20/1980	5.3 miles
Alpha Charles Childs House 80003111	Lake	Madison	10/20/1980	5.1 miles
Robertus W. Childs House 80003112	Lake	Madison	10/20/1980	5.1 miles
George Damon House 80003113	Lake	Madison	10/20/1980	4.6 miles
James Dayton House 8003114	Lake	Madison	10/20/1980	5.1 miles
James Dayton House II 80003115	Lake	Madison	10/20/1980	5.0 miles
Albert DeHeck House 80003116	Lake	Madison	10/20/1980	4.9 miles
Francis Ensign Fuller House 80003117	Lake	Madison	10/20/1980	4.6 miles

Table 3.8-4 NRHP Properties within 6 Miles of PNPP (Page 2 of 2)

Resource Name NRHP listing	County	Quadrangle	NRHP Listed	Distance from PNPP[(a)]
Jane Gilbert House 80003118	Lake	Madison	10/20/1980	5.2 miles
H. Gill House 80003119	Lake	Madison	10/20/1980	5.4 miles
Francis Hendry House 80003120	Lake	Madison	10/20/1980	5.1 miles
Cyrus J. Ingersoll House 80003121	Lake	Madison	10/20/1980	5.1 miles
John J. Jones House 80003122	Lake	Madison	10/20/1980	5.2 miles
John Kellogg House and Barn 80003123	Lake	Madison	10/20/1980	5.5 miles
Solomon Kimball House 80003124	Lake	Madison	10/20/1980	5.0 miles
William Lyman House 80003125	Lake	Madison	10/20/1980	4.7 miles
Rev. Harlan Metcalf House 80003126	Lake	Madison	10/20/1980	5.1 miles
Norfolk and Western Freight Station 80003127	Lake	Madison	10/20/1980	5.3 miles
George Pease House 80003128	Lake	Madison	10/20/1980	4.8 miles
Orland Selby House 80003129	Lake	Madison	10/20/1980	5.9 miles
David Smead House 80003130	Lake	Madison	10/20/1980	5.6 miles
Joseph Talcott House 80003131	Lake	Madison	10/20/1980	5.5 miles
Edwin L. Ware House 80003132	Lake	Madison	10/20/1980	5.1 miles
George D. Wilson House 80003133	Lake	Madison	10/20/1980	5.5 miles
Town Center District with 12 contributing properties 80004247	Lake	Madison	10/20/1980	5.3 miles
Mr. & Mrs. Karl A Staley House 14000042	Lake	Madison	03/4/2014	4.7 miles

(OMS-OHC 2022)

a. Distances are approximate and based on the PNPP unit one center point and NRHP location data.

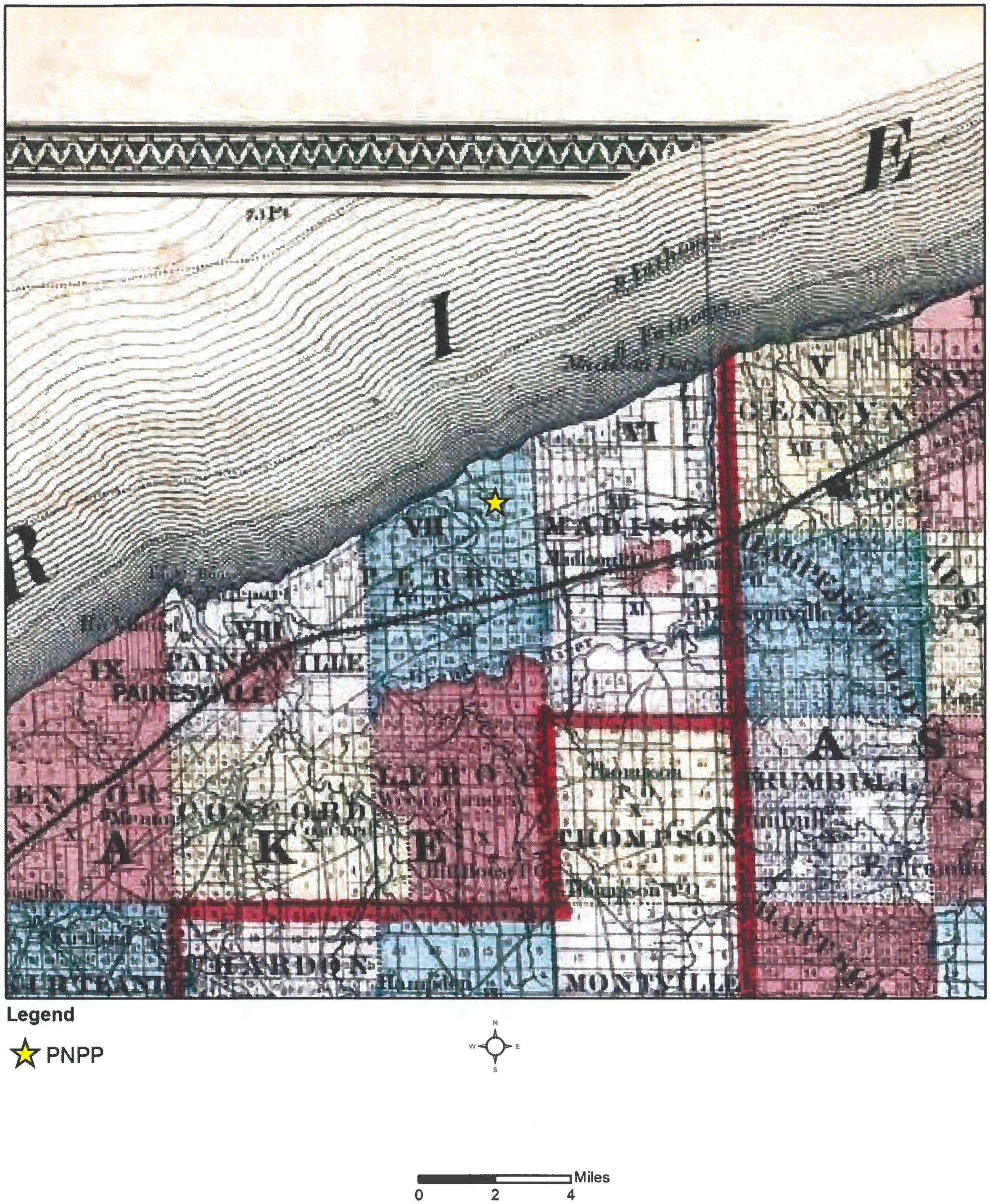


Figure 3.8-1 Historical Ohio Topography Map 1868

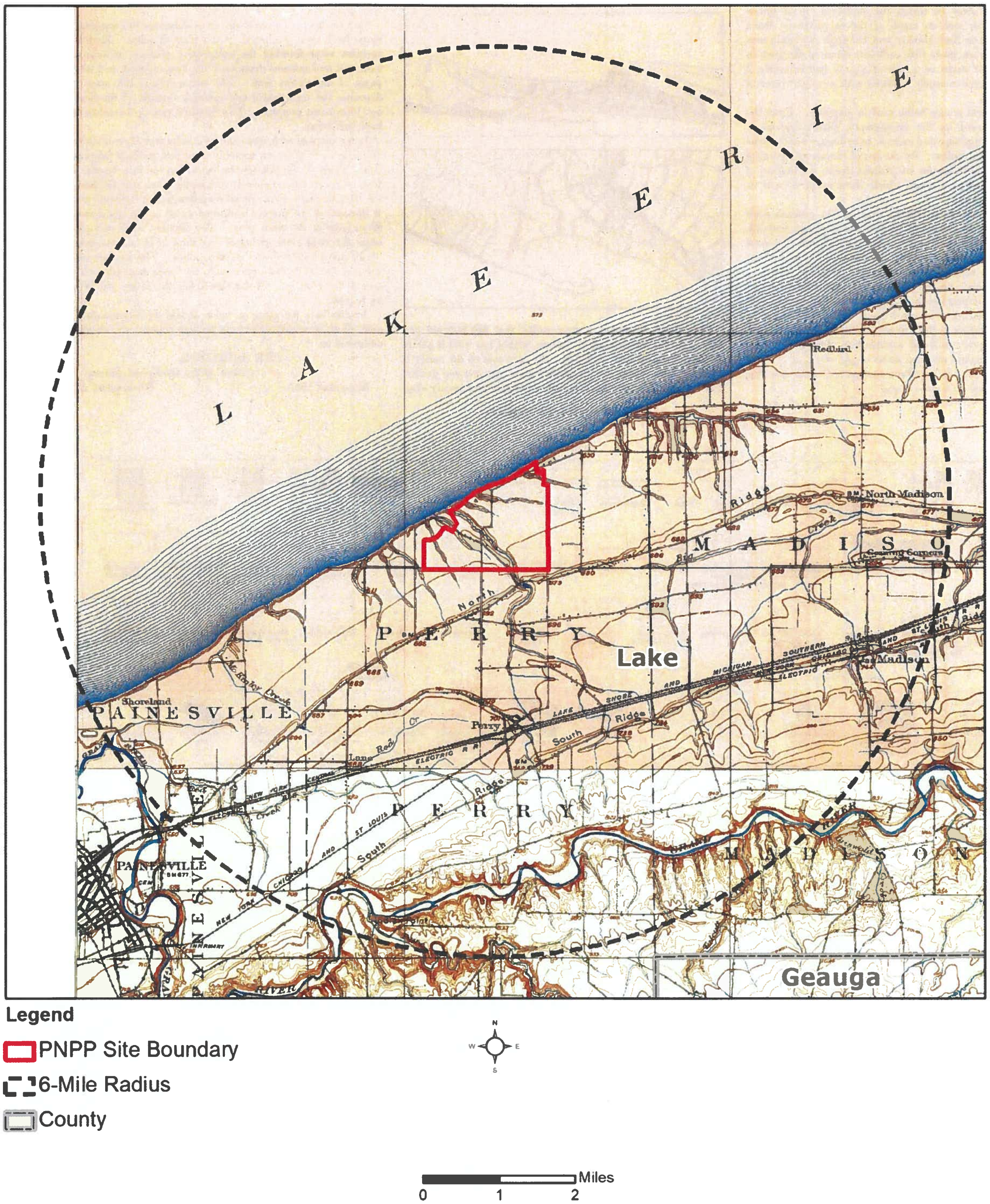


Figure 3.8-2 USGS 1904 and 1905 Topography Map

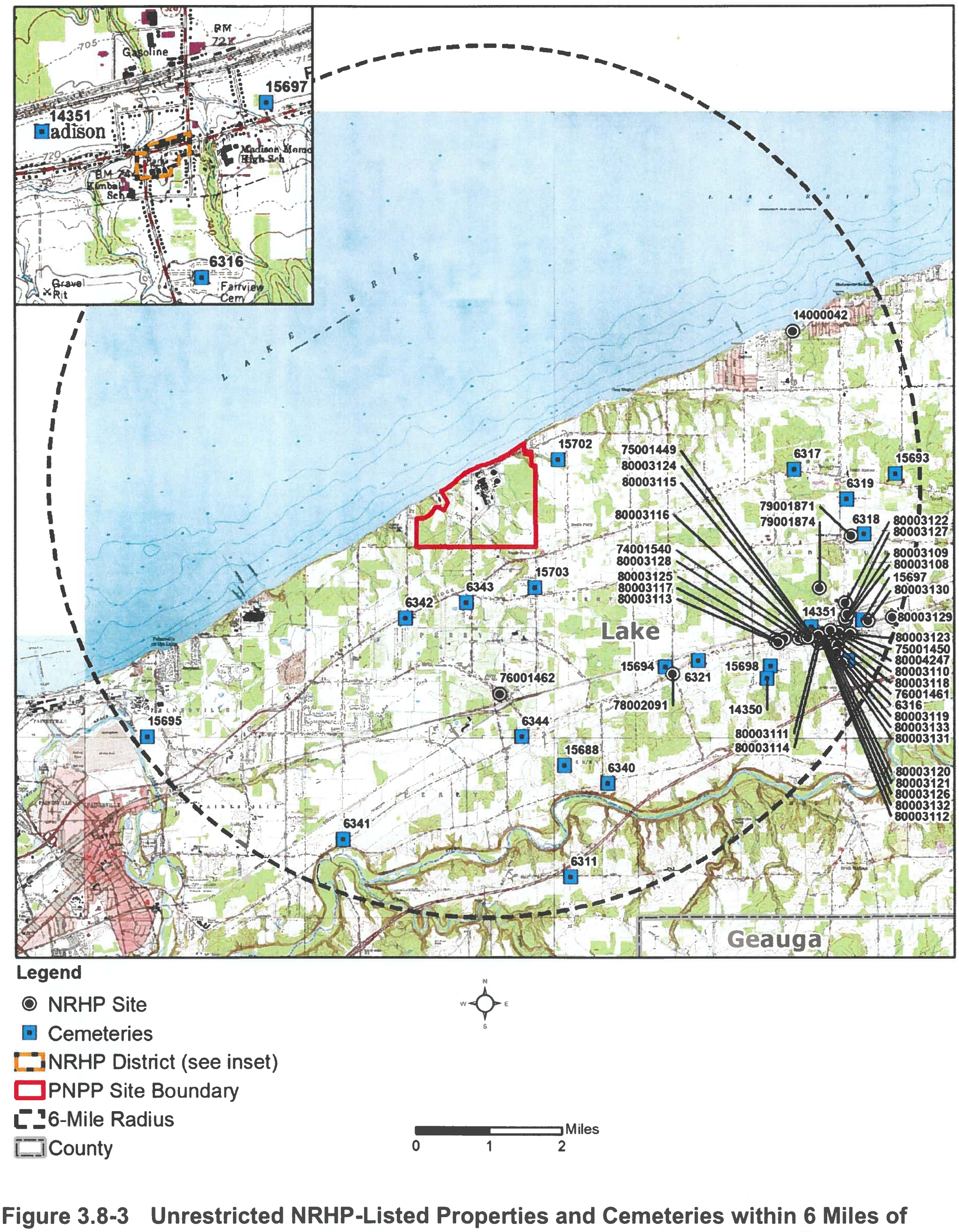


Figure 3.8-3 Unrestricted NRHP-Listed Properties and Cemeteries within 6 Miles of PNPP

Figure 3.8-4 Preconstruction Photograph of the PNPP Site, October 21, 1974

Figure 3.8-5 Construction Photograph of the PNPP Site, September 1975

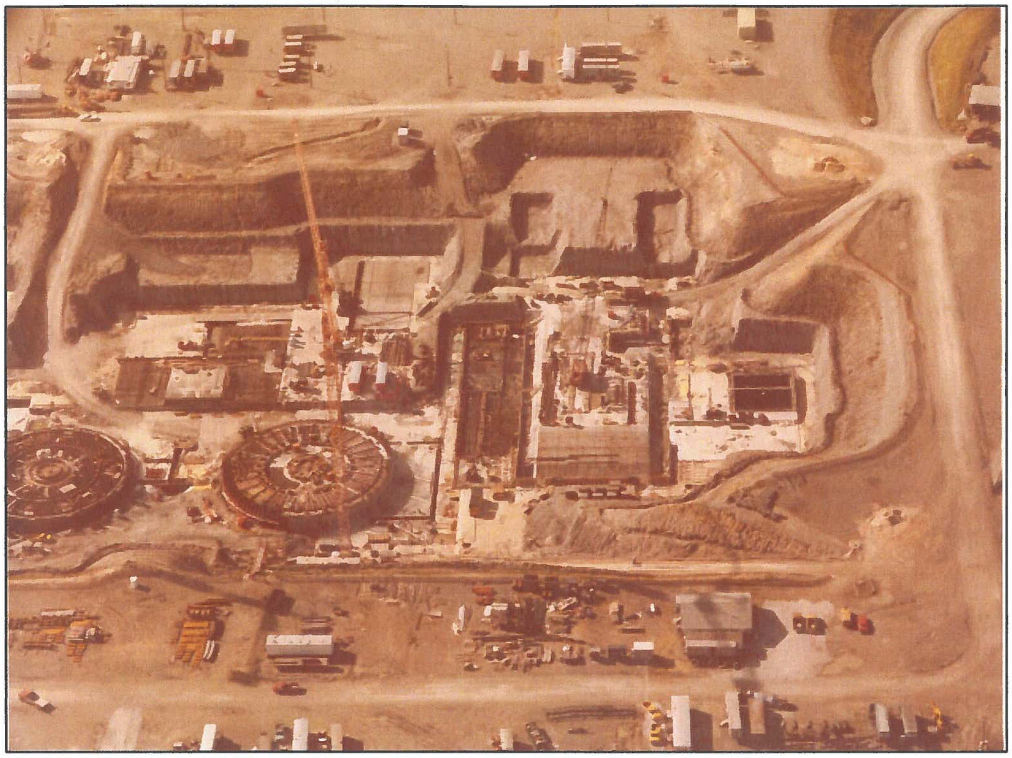


Figure 3.8-6 Construction Photograph of the PNPP Site, November 1976

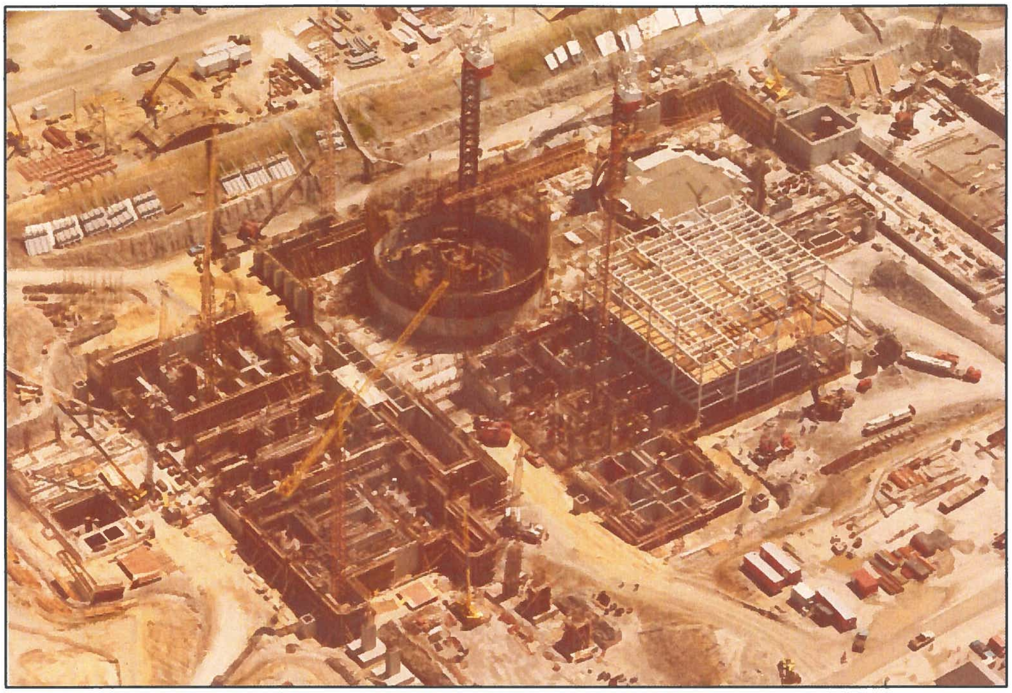


Figure 3.8-7 Construction Photograph of the PNPP Site, June 1977

Figure 3.8-8 Construction Photograph of the PNPP Site, June 1982

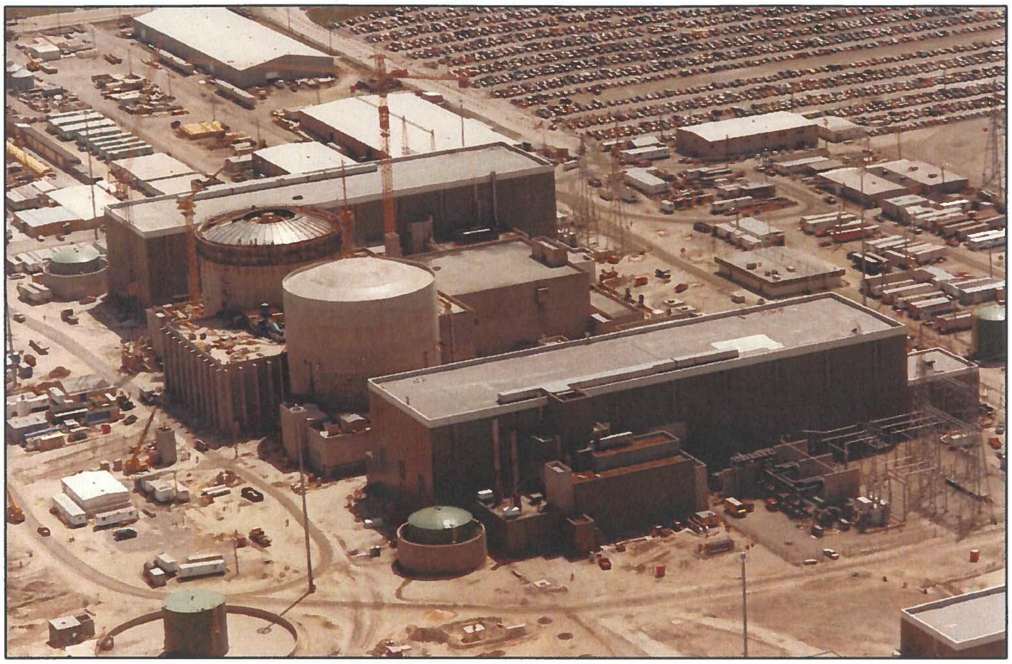


Figure 3.8-9 Construction Photograph of the PNPP Site, May 1983

Figure 3.8-10 Post-Construction Photograph of PNPP Site, August 1984

3.9 Socioeconomics

The socioeconomic description focuses on Lake County, because approximately 60 percent of the PNPP workforce resides there. The remaining workforce is dispersed throughout the states of Ohio and Pennsylvania (Table 2.5-1). As presented in Section 2.5, during the last five refueling outages, which each lasted an average of 39 days, an average of 1,323 contract employees were on site.

As seen in Figure 3.1-4, several nearby Ohio cities are within PNPP's 50-mile radius, including Painesville, Ashtabula, and the larger urban area of Cleveland. These communities offer numerous motels, campgrounds, and food service conveniences for contract workers who provide temporary staffing support to PNPP. Transportation corridors such as I-90, US 20/N. Ridge Rd, and various local roads provide workforce commuter access to PNPP.

3.9.1 Employment and Income

Lake County is the geographic area that is most influenced by PNPP. Additionally, PNPP is an Energy Harbor asset with assessed property taxes distributed to various taxing jurisdictions within Lake County. Low-income populations and poverty thresholds for the county are described in Section 3.11.2.

Lake County falls within the Cleveland-Elyria MSA inside the Cleveland-Akron-Canton CSA (Section 3.1). The employed population of Lake County in 2020 was 119,512. The leading reported occupational sector was manufacturing, with approximately 18.0 percent, or 21,453 persons, employed. This was followed by retail trade with 11.9 percent, or 14,115 persons employed; and health care and social assistance with 10.4 percent, or 12,378 persons employed. The annual personal income in Lake County was approximately $12.9 billion in 2020, and the average wage per job was $51,586. In 2020, per capita personal income was $56,085. (BEA 2022). In the last decade, the annual average unemployment rate in Lake County had dropped steadily from a reported recent high in 2011 (6.8 percent) to 3.8 percent in 2019. In 2020, during the Covid 19 pandemic the annual average unemployment rate jumped to 8.4 percent. In 2021 the preliminary average unemployment rate for Lake County was 4.3 percent. (BLS 2022) Lake County's top employers include University Hospitals Tripoint Medical Center and Lincoln Electric (LC 2022c).

3.9.2 Housing

Between 2010 and 2020, Lake County saw a small increase in population. See Table 3.11-3 for a description of Lake County population growth trends anticipated for the PEO.

As presented in Table 3.9-1, vacant housing unit availability fell slightly between 2010 and 2019 in Lake County, although the percent of vacant housing in 2019 remains high enough to support a population increase. In 2019, Lake County's available housing was an estimated 6.3 percent. (USCB 2022g)

Table 3.9-1 also shows Lake County experienced a small increase in median housing values. Between 2010 and 2019, the median housing value rose by 7.5 percent in Lake County, to a median value of 164,000. Between 2010 and 2019, median monthly rent grew by 18.1 percent in Lake County and was $879 a month in 2019. (USCB 2022g)

3.9.3 Water Supply and Wastewater

The following community water supply and wastewater discussion focuses on Lake County where PNPP is located. Lake County provides all water service to residents who do not have individual onsite wells by monitoring and overseeing water quality and distribution of water sourced from Lake Erie. The system is divided into two districts, the East and West sub-districts, with a total design capacity of 29 MGD. (LC 2022d) Private residential water well contamination testing is administered through the Lake County General Health District. The Lake County General Health District estimates about half of the homes in Lake County have private well water, particularly in rural areas. (IS 2022)

The Soil and Water Conservation District in Lake County provides leadership and technical expertise to guide the protection and conservation of unique county soil and water resources (LC 2022e). Along with the Soil and Water Conservation District, water resource management is shared with several local and state agencies and partners. The ODNR Division of Water Resources (ODNR-DWR) oversees water inventory and planning throughout the state of Ohio. ODNR-DWR, and by extension Lake County, adheres to the Great Lakes Compact, a legally binding agreement between all states bordering the Great Lakes that prohibits large-scale water diversion from the Great Lakes basin. ODNR-DWR conducts water supply planning system by system. This analysis includes inventorying the existing source and treatment facilities, projecting water use into the future, comparing projected water use with existing system yields, identifying projected deficiencies, and formulating alternatives for developing supplies to meet projected needs. Water supply in Ohio is considered abundant but in need of conservation and protection to maintain adequate supply. (ODNR 2022g)

Lake County's Sanitary Sewer Division is responsible for wastewater treatment at six plants. The Gary L. Kron Water Reclamation Facility, located in Mentor, serves the central portion of the county, and the Madison Wastewater Treatment Facility, located in Madison, serves most of the eastern portion of the county. The two facilities have a combined design capacity of 25 MGD and discharge their effluent to Lake Erie, whereas the four remaining fully automated package plants serve smaller subdivisions and discharge their effluent to various nearby creeks and rivers. (LC 2022d)

For individual home sewage treatment systems, the Ohio Administrative Code 3701-29-09(I) was adopted in 2015 and Ohio residents with septic systems must participate (by mandate) in their local operation and maintenance program to ensure home systems are monitored for regular maintenance and proper function. Lake County is estimated to have around 15,000 private home sewage treatment systems in total. To date about one third of Lake County systems have been phased into the program. All remaining systems are scheduled for enrollment by 2025. (LCGHD 2022)

Section 3.6.3.1 describes PNPP's domestic water supply system, which is obtained from the onsite Lake County Department of Utilities water main. PNPP does not treat sanitary wastewater on site but relies on public wastewater treatment facilities for disposal (Section 3.6.1.2.3).

3.9.4 Community Services and Education

For Lake County emergency services, law enforcement is provided through various agencies, including the Lake County Sheriff's Office and 18 community police departments. Nearby PNPP are Perry Village, North Perry Village, Madison Township, and Painesville police departments. (USACOPS 2022) Sixteen community fire departments serve Lake County, with 28 stations and 380 active and volunteer firefighters (USFA 2022).

Lake County's medical needs are primarily served by the University Hospitals Tripoint Medical Center. According to the US Department of Health and Human Services, as of 2022 there were seven hospital facilities with a total of 1,109 inpatient beds within a 25-mile radius of PNPP. The closest, University Hospitals Health Systems Memorial Hospital of Geneva, had 30 inpatient beds, followed by Lake Health in Concord Township, with 233 inpatient beds. (HHS 2022)

As of the 2020-2021 school year, Lake County featured 13 public school districts with 29,642 students and 56 schools. Mentor Exempted Village is the largest district by student population with 12 schools and 7,529 students, though Perry Local is the closest school district to PNPP and directly benefits from property tax payments (Section 3.9.5). Perry Local consists of three schools serving 1,522 students. For the 2019-2020 school year, Lake County featured 11 private schools serving 3,092 students (NCES 2022). PNPP tax payments also benefit Auburn Career Center which serves adults and high school students from across the region. Auburn Career Center educational programs range from technical to college preparatory. (ACC 2022)

Within the PNPP 50-mile region, there are 21 public and private four-year higher education facilities and 21 two-year facilities. Located within approximately 25 miles of the village of Perry are five four-year schools: These include Kent State University at Ashtabula, Kent State University at Geauga, Lake Erie College, Rabbinical College Telshe, and Ursuline College. Lakeland Community College is the nearest two-year college, approximately 17 miles from the village of Perry. (NCES 2022)

3.9.5 Local Government Revenues

Energy Harbor provides an annual property tax payment to Lake County, which then distributes the payment to various County tax jurisdictions on behalf of PNPP. The largest of these tax payments is distributed to Perry Local School District (LSD) and Lake County itself. Other notable recipients include Perry TWP, North Perry Corporation, Auburn Joint Vocational School

District (JVSD), Lakeland Community College, Metropolitan Park District, Lake County Financing District, Perry TWP Library District, and Perry Joint Fire District. Tax payments are determined by property appraisal, and the Lake County auditor is responsible for the valuation of real estate via the Lake County Appraisal Department (LC 2022f).

See Table 3.9-2 for total annual property tax payments to Lake County and its tax jurisdictions for the years 2017 through 2021, along with an evaluation of PNPP property tax as a percent of Lake County's total revenues. The PNPP total annual property tax payment to tax jurisdictions in 2021 was $ 7,705,161.90. Energy Harbor's annual property tax payments for PNPP have remained consistent over the last four years. Energy Harbor does not anticipate any changes in state and local tax laws, rates, and assessed property value. However, new annual lease payments to the State of Ohio for a reissued Halite Non-Extraction Lease agreement to protect the Lake Erie intake and discharge tunnel lakebed area from subsidence began in 2022. These payments are anticipated to be in the range of $50,000-75,000 per year during the full PEO.

In 2021, Energy Harbor contributed approximately $620,940 in annual grant payments to the following entities on behalf of PNPP for emergency plan support: Geauga County, Ashtabula County Emergency Management Agency, Ashtabula County Radiological Emergency Preparedness Plan, Lake County Emergency Management Agency, and Lake County Health.

PNPP established the Energy Harbor Community Involvement Committee in 2021. The goal of this committee is to support the communities local to PNPP and Energy Harbor offices. Through outreach and volunteerism, four local organizations have received committee sponsorship, including: Concord Township, Footprints Center for Autism, Leadership Lake County, and National Alliance on Mental Illness. PNPP staff also participates in community outreach events through industry-specific organizations such as North American Young Generation in Nuclear and Women in Nuclear. In 2021, North American Young Generation in Nuclear and Women in Nuclear partnered with the Salvation Army of Lake County to sponsor the annual Adopt-A-Family drive. For the Energy Harbor United Way annual campaign approximately 440 Energy Harbor employees participated, pledging nearly $250,000 to over 170 different organizations. At PNPP, over 91 employees pledged approximately $37,000 to local communities. Additionally, over 200 PNPP employees donated approximately $26,000, plus food items to local food pantries via the annual Harvest for Hunger campaign.

3.9.6 Transportation

As discussed in Section 3.1, transportation in the PNPP region includes a rural and urbanized road network, plus rail and air travel (Figures 3.1-3 and 3.1-4). I-90 moves traffic between Cleveland, OH and Buffalo, NY and provides commuter access to the plant from communities in the region. South of PNPP, US 20/N. Ridge Rd, a four-lane paved highway, traverses the cities and villages located along the shoreline of Lake Erie, routing local and commuter traffic to the PNPP entrance road. Providing access to the plant itself, from US 20/N. Ridge Rd are paved two-lane local streets, Parmly Rd and Center Rd. There are dedicated turn lanes and signal lights on US 20/N. Ridge Rd at the intersection with Center Rd, but there are no turn lanes and signal lights at the intersection of US 20/N. Ridge Rd with Parmly Rd.

The Ohio Department of Transportation (ODOT) average annual daily traffic (AADT) volumes for US 20/N. Ridge Rd are listed in Table 3.9-3. Traffic volume counts on US 20/N. Ridge Rd east of the intersection with Center Rd have been on the rise since 2016, whereas traffic volume counts on US 20/N. Ridge Rd west of the intersection with Parmly Rd have stayed consistent since 2011. On US 20/N. Ridge Rd, the most recent 2021 AADT count east of Parmly Rd was 15,538, and the most recent count west of Center Rd was 21,439. (ODOT 2022c).

The U.S. Transportation Research Board developed a commonly used indicator called level of service (LOS) to measure how well a road accommodates traffic flow. LOS is a qualitative assessment of traffic flow and how much delay the average vehicle might encounter during peak hours. LOS categories are listed and defined Table 3.9-4.

No recent ODOT traffic studies specific to US 20/N. Ridge Rd in the PNPP vicinity were available. To provide a current evaluation of LOS for US 20/N. Ridge Rd, the known AADT traffic volumes were compared to the estimated capacity of a multilane highway, as presented in the U.S. Transportation Research Board highway capacity manual. The manual notes that the capacity of a multilane highway under base conditions varies with the free flow speed (FFS). For 60-mph FFS, the capacity is 2,200 passenger cars per hour per lane (pc/h/ln). For lower FFSs, capacity diminishes (e.g., for 45-mph FFS, capacity is 1,900 pc/h/ln). The highway capacity manual also notes that speeds remain constant until they reach 1,400 pc/h/ln, after which speeds decline with further increases in flow rate. Based on ODOT's AADT recorded volumes, the US 20/N Ridge Rd traffic count location west of Center Rd would have a reported flow rate of approximately 223 pc/h/ln, and US20/N Ridge Rd east of Parmly Rd would have a reported flow rate of approximately 162 pc/h/ln, on average. Because the base condition capacities for a multilane highway are not exceeded by the current average traffic conditions, there should be ample traffic capacity on US 20/N. Ridge Rd in the vicinity of PNPP. US 20/N Ridge Rd should fall within the LOS "A" to "C" range of conditions. (ODOT 2022c)

Ohio's STIP for 2021-2024 has listed several highway projects for Lake County. One identified 2022 STIP project located within Perry TWP is described as a major rehabilitation of US 20/N. Ridge Rd involving minor widening and drainage replacement (ODOT 2022a). A suburban lifestyle reliant on the automobile is typical for residents of Lake County, but the County five-year consolidated plan highlights the need for more efficient public transportation networks that would support low-income populations access to areas in the county where the most jobs are located (LC 2022g).

3.9.7 Recreational Facilities

There is an abundance of outdoor recreational opportunities located across Lake County (Figure 3.1-5 and Figure 3.1-6). As discussed in Section 3.1, a list of federal, state, and local lands that fall within the PNPP vicinity can be found in Table 3.1-1.

A national scenic byway, the Lake Erie Coastal Trail spans a route of 293 miles following the shoreline of Lake Erie from the city of Toledo east to the Pennsylvania border, passing through Lake County communities and the 6-mile vicinity of PNPP (OH 2022). Lake County sees more than 3.5 million annual visitors at its 37 public parks and recreational facilities. Unique Lake County recreational and educational experiences include an agriculturally themed park, a nature center, an education, and wildlife rehabilitation center, two golf courses, a cross-county ski center, and more than 50 miles of trails. Two of Lake County's parks provide for cabin camping, while rustic tent camping is available at 10 park sites located across the county. (LMP 2022b) Situated on Lake Erie near the village of Fairport Harbor, the Headlands Beach State Park offers day use recreational activities such as swimming, fishing, and hiking (ODNR 2022h) Portions of two state-designated "wild and scenic" rivers, the Chagrin River and the Grand River, flow through and are protected by Lake County. A stretch of the Grand River falls within the PNPP 6-mile vicinity. (ODNR 2022a) No data on projected percentage of Lake County visitor use was available. There are no public parks located within the PNPP site boundary.

In 2018 and 2019, the number of visitors to PNPP averaged 50 persons a year and three tour groups. In 2019 PNPP also hosted a family safety day that was attended by approximately 50 visitors. The COVID-19 pandemic limited visitors at PNPP in 2020 and 2021 to two tours per year and 20 people total. Currently, there are no plans to change public accessibility at the PNPP site. The plant recently hosted a school tour with 24 students. PNPP has no publicly accessible special use areas, such as boat ramps or picnic areas within the site boundary.

Table 3.9-1 Housing statistics, 2010 and 2019

Name	2010	2019	2010 to 2019 Change (%)
Lake County			
Total Housing Units	101,205	103,499	2.3
Occupied Units	93,928	96,967	3.2
Vacancy Units	7,277	6,532	-10.2
Vacancy (percent)	7.2	6.3	-0.9
Median House Value ($)	152,600	164,000	7.5
Median Rent ($/month)	744	879	18.1

(USCB 2022g)

Table 3.9-2 PNPP Total Property Tax Payment by Lake County Tax Jurisdiction, 2017-2021 (Sheet 1 of 2)

2017 Distribution	PNPP Payment	Total County Revenue
Lake County	1,440,130.59	49,710,633.51
Perry TWP	594,047.87	20,505,429.14
Perry LSD	5,840,550.10	201,604,942.72
North Perry Corporation	472,555.47	16,311,737.29
Auburn JVSD	211,793.73	7,310,726.09
Lakeland Community College	495,248.50	17,095,058.38
Metropolitan Park District	402,972.26	13,909,854.09
Lake County Financing District	687,670.40	23,737,105.19
Perry TWP Library District	247,092.77	8,529,183.54
Perry Joint Fire District	635,381.17	21,932,178.09
Special Assessment	-	-
Total 2017 PNPP Property Tax Payment is approximately 2.9% of Lake County revenues	11,027,442.86	380,646,848.03
2018 Distribution	**PNPP Payment**	**Total County Revenue**
Lake County	966,520.39	52,348,259.80
Perry TWP	390,984.38	21,176,327.07
Perry LSD	3,814,582.92	206,603,792.09
North Perry Corporation	403,943.76	21,878,227.41
Auburn JVSD	142,775.67	7,732,954.16
Lakeland Community College	334,074.91	18,094,020.94
Metropolitan Park District	260,875.76	14,129,440.21
Lake County Financing District	466,400.52	25,260,983.46
Perry TWP Library District	166,571.62	9,021,780.12
Perry Joint Fire District	428,327.01	23,198,862.47
Special Assessment	-	-
Total 2018 PNPP Property Tax Payment is approximately 1.8 percent of Lake County revenues	7,375,056.94	399,444,647.73
2019 Distribution	**PNPP Payment**	**Total County Revenue**
Lake County	969,004.31	52,014,124.33
Perry TWP	404,671.14	21,721,900.28
Perry LSD	3,822,835.87	205,201,832.63
North Perry Corporation	404,320.62	21,703,085.10
Auburn JVSD	142,873.62	7,669,157.05
Lakeland Community College	334,928.38	17,978,254.81
Metropolitan Park District	261,581.47	14,041,146.12

Table 3.9-2 PNPP Total Property Tax Payment by Lake County Tax Jurisdiction, 2017-2021 (Sheet 2 of 2)

2017 Distribution	PNPP Payment	Total County Revenue
Lake County Financing District	463,458.65	24,877,490.84
Perry TWP Library District	166,685.89	8,947,349.89
Perry Joint Fire District	428,620.89	23,007,472.76
Special Assessment	-	-
Total 2019 PNPP Property Tax Payment is approximately 1.9 percent of Lake County revenues	7,398,980.84	397,161,813.80
2020 Distribution	**PNPP Payment**	**Total County Revenue**
Lake County	1,001,773.18	53,489,739.45
Perry TWP	418,766.05	22,360,038.53
Perry LSD	3,971,161.75	212,040,421.47
North Perry Corporation	412,038.33	22,000,811.51
Auburn JVSD	147,907.29	7,897,518.68
Lakeland Community College	345,224.26	18,433,270.21
Metropolitan Park District	270,360.17	14,435,897.61
Lake County Financing District	478,697.45	25,560,079.25
Perry TWP Library District	172,558.67	9,213,780.61
Perry Joint Fire District	443,721.85	23,692,554.98
Special Assessment	1,522.90	-
Total 2020 PNPP Property Tax Payment is approximately 1.9 percent of Lake County revenues	7,663,731.90	409,124,112.30
2021 Distribution	**PNPP Payment**	**Total County Revenue**
Lake County	1,002,841.04	55,105,143.92
Perry TWP	419,212.57	23,035,324.72
Perry LSD	3,976,261.93	218,491,742.12
North Perry Corporation	412,301.00	22,655,540.64
Auburn JVSD	148,071.01	8,136,358.60
Lakeland Community College	341,642.23	18,772,909.66
Metropolitan Park District	310,128.94	17,041,284.90
Lake County Financing District	477,740.49	26,251,377.24
Perry TWP Library District	172,749.68	9,492,427.61
Perry Joint Fire District	444,213.01	24,409,074.69
Special Assessment	-	-
Total 2021 PNPP Property Tax Payment is approximately 1.8 percent of Lake County revenues	7,705,161.90	423,391,184.10

Table 3.9-3 Total Average Annual Daily Traffic Counts on US 20/N. Ridge Rd

Route	Location	2011	2016	2021
US 20/N. Ridge Rd	West of Center Rd	14,760	12,691	21,439
US 20/N. Ridge Rd	East of Parmly Rd	15,400	15,675	15,538

(ODOT 2022c)

Table 3.9-4 Level of Service Definitions

Level of Service	Conditions
A	Free flow of the traffic stream; users are mostly unaffected by the presence of other vehicles.
B	Free flow of the traffic stream, although the presence of other vehicles becomes noticeable. Drivers have slightly less freedom to maneuver.
C	The influence of the traffic density on operations becomes marked and queues may be expected to form. The ability to maneuver with the traffic stream is clearly affected by other vehicles.
D	The ability to maneuver is severely restricted due to traffic congestion. Travel speed is reduced by the increasing volume. Only minor disruptions can be absorbed without extensive queues forming and the service deteriorating.
E	Operations at or near capacity, an unstable level. The densities vary, depending on the free-flow speed. Vehicles are operating with the minimum spacing (or gaps) for maintaining uniform flow. Disruptions cannot be dissipated readily, often causing queues to form and service to deteriorate to LOS F.
F	Forced or breakdown of flow. It occurs either when vehicles arrive at a rate greater than the rate at which they are discharged or when the forecast demand exceeds the computed capacity. Queues form behind these breakdowns. Operations within queues are highly unstable, with vehicles experiencing brief periods of movement followed by stoppages.

3.10 Human Health

This section describes site conditions likely to contribute to the occurrence of pathogenic thermophilic microbiological organisms; methodology and procedures designed to meet the regulatory requirements and standards for limiting potential induced current hazards arising from energized in-scope transmission lines; and a description of the plant's radiological health environment and preventative measures necessary to reduce potential exposure levels to plant workers and visitors during plant operations.

3.10.1 Microbiological Hazards

In the GEIS, the NRC considered health impacts from thermophilic microorganisms posed to both the public and plant workers because ideal conditions for thermophilic microorganisms can result from nuclear facility operations and discharges. Microorganisms of particular concern include several types of bacteria (*Legionella* species, *Salmonella* species, *Shigella* species, and *Pseudomonas aeruginosa*) and the free-living amoeba *Naegleria fowleri*. The public can be exposed to the thermophilic microorganisms *Salmonella*, *Shigella*, *P. aeruginosa*, and *N. fowleri* during swimming, boating, or other recreational uses of freshwater. If a nuclear plant's thermal effluent enhances the growth of thermophilic microorganisms in waters open for recreational use, recreational users could experience an elevated risk of exposure when using waters near the plant's discharge. (NRC 2013a; NRC 2020a)

Legionella is a genus of common warm water bacteria that occurs in lakes, ponds, and other surface waters, as well as some groundwater sources and soils. *Legionella* optimally grow in stagnant surface waters with biofilms or slimes that range in temperature from 95°F to 113°F, although the bacteria can persist in waters from 68°F to 122°F. The bacteria are only pathogenic to humans when aerosolized and inhaled into the lungs. As such, human infection is often associated with complex water systems housed within buildings or structures, such as cooling towers. (NRC 2020a)

Naegleria fowleri is ubiquitous in nature and thrives in water bodies at temperatures ranging from 95°F to106°F or higher and is rarely found in water cooler than 95°F. Infection rarely occurs in water temperatures of 95°F or less (NRC 2013a). Infections occur when *N. fowleri* penetrates the nasal tissue through direct contact with water in warm lakes, rivers, or hot springs and migrates to the brain tissues (CDC 2021a). There have been no cases of primary amebic meningoencephalitis, the infection caused by *N. fowleri*, in Ohio from 1962–2020 (CDC 2021a).

The other human pathogens mentioned above have infection routes of contact with infected persons or contaminated water, food, soil, or other contaminated material. The exposure route of concern would be contact with contaminated water containing a population of microorganisms sufficient for human infection. The pathogens can grow at a range of temperatures, but as human pathogens, have an optimal growth temperature around the human body temperature. The most current data on the Centers for Disease Control and Prevention for waterborne illness outbreaks in untreated recreational water is from 2013-2014. The 2013-2014 data lists one waterborne illness outbreak in Ohio resulting in two hospitalizations (CDC 2019). This outbreak was attributed to *Leptospira* sp. which is not one of the microorganisms of particular concern.

As discussed in Section 2.2, PNPP uses a circulating water system to remove thermal energy from the condensers and dissipates the energy to the atmosphere in a closed system utilizing one natural draft cooling tower. Under the control of an NPDES permit (Attachment B), PNPP releases blowdown water from the cooling tower to Lake Erie to prevent the buildup of salts and solids in the cooling tower basin. The intake water is treated as needed to prevent biofouling. As shown in the NDPES permit included in Attachment B, the permit limits the concentration of chlorine- and bromine-based biocides in the discharge based on the duration of use per day. The NDPES permit calls for measurement of the concentration in the discharge via grab samples when biocides are being used. For use greater than 120 minutes in a day, total residual chlorine is limited to 0.038 milligrams per liter (mg/L) and total residual oxidants (reflects the use of bromine compounds) is limited to 0.01 mg/L.

Water is returned to the lake through the discharge tunnel with the discharge point located at the bottom of Lake Erie. The water in the discharge tunnel is released to Lake Erie waters about 12.2 feet below the surface of the water and approximately 1,650 feet from shore. The release is through a nozzle which directs the water perpendicularly away from the shoreline to promote rapid mixing of the discharge with the lake. The thermal plume analysis conducted for the operating stage ER predicted in most cases only a small surface plume within the 1°F isotherm (NRC 1982). PNPP implemented a 5 percent power uprate following its approval by NRC in 2000. NRC evaluated the impact of the uprate and issued a Finding of No Significant Impact (65 FR 26858). The maximum summer discharge temperature for the service water system was projected to be 90.44 °F (65 FR 26858). Figure 2.2-1 shows a range of temperatures in the plant's discharge to Lake Erie. The higher end of the range is attributable to an Emergency Service Water release occurring during off normal or accident conditions rather than normal operations. During the summer months of 2018-2022, the daily temperature in the discharge to Lake Erie averaged in the 70s and 80s. The maximum daily discharge temperature occurred in August 2021 and was 91°F. The discharge temperature is not sufficient for *Naegleria* to thrive. Further, the discharge structure is located at the bottom of Lake Erie and is designed to rapidly mix the discharge with the receiving waters of Lake Erie. *Naegleria* would not be a hazard to recreational water users near the PNPP discharge.

Legionella can be a hazard to plant workers performing maintenance in cooling towers and on condenser tubes. The cooling tower is within the plant's protected area and is not accessible to the public, so *Legionella* exposure does not pose a public health hazard. Procedures for work at the cooling tower during outages when the cooling tower is out of service to conduct inspections and minor repairs call for respiratory protection due to asbestos and potential exposure to *Legionella*. Additional monitoring and precautions including sampling for *Legionella* and respiratory protection as indicated are taken for work at the cooling tower while in service. Internal cleanliness of the condenser tubes is maintained through the use of chemicals and biocide (EH 2021a). Condenser maintenance involves waterbox entry which is covered by the plant's confined space program that addresses monitoring of the atmosphere prior to entry and use of respiratory protection as appropriate.

Algal blooms have become more noticeable in Ohio's lakes, streams, and rivers during the last few years. Most blooms are green algae and not harmful. Some blooms are a type of cyanobacteria that have the ability to produce toxins and are known as HABs (OEPA 2022d). HABs can impact recreational activities that occur in the open waters of lakes and rivers such as boating and jet skiing. However, the potential exposure to cyanotoxins is much greater at beaches where people engage in full submersion swimming. The OEPA monitors satellite imagery for blooms and the ODNR conducts visual inspections and sampling at state park beaches in response to the presence of cyanobacterial blooms. ODNR posts advisories and caution signs at state park beaches and boat ramps when necessary. (OEPA 2022e) The NOAA forecasts and monitors HABs for the Great Lakes. PNPP is along an area of the Lake Erie coastline with low potential for HABs (NOAA 2021).

3.10.2 Electric Shock Hazards

The electric field created by high-voltage lines can extend from the energized conductors on the lines to other conducting objects, such as the ground, vegetation, buildings, vehicles, and persons if appropriate clearances are not maintained, posing a shock hazard for the public and workers. To minimize the shock that could be experienced by someone touching an object that is capacitively charged, the clearance between the power lines and the object must limit the induced current to a low enough electrical charge. The NESC contains the basic provisions considered necessary for the safety of workers and the public.

The in-scope transmission lines at PNPP are depicted on Figure 2.2-2. The in-scope transmission lines include the lines to the Perry Unit 1 and Unit 2 Startup Transformers and the line to the Main Transformer each spanning between the switchyard and the power block. The switchyard is within a fenced, restricted access area and the power block is within the plant protected area boundary. The span between these fenced areas crosses a restricted site access road. The in-scope transmission lines are within the Energy Harbor OCA, minimizing risk to the public due to restricted site access.

In 2022, the in-scope transmission lines were evaluated by FirstEnergy for compliance with 2017 NESC clearance standards. The clearance study used computer-based modelling of the existing line structures and conductor sag. The evaluation was conducted at nominal and blowout conditions and concluded that there were no clearance concerns.

Maintenance activities are controlled by procedures. Work on the Energy Harbor site is governed by a comprehensive industrial safety program with programmatic and tiered specific activity procedures. The industrial safety program complies with applicable requirements of the OSHA Standard for Electrical Power Generation, Transmission, and Distribution [29 CFR 1910.269]. The program addresses electrical safety, clearance, and safety tagging, use of ladders and portable equipment, etc. Additional instructions are provided for using cranes and man lifts to ensure these are placed and operated safely.

3.10.3 Radiological Hazards

As required by NRC regulations at 10 CFR 20.1101, "Radiation protection programs," Energy Harbor designed a radiation protection program to protect onsite personnel (including employees and contractor employees), visitors, and offsite members of the public from radiation and radioactive material at PNPP. There are no proposed changes or upgrades being considered for the current or license renewal term; however, the program would be revised as necessary to ensure compliance with NRC, EPA, or OSHA regulations and to continue to meet ALARA principles. NRC regulations require that gaseous and liquid radioactive releases from nuclear power plants must meet radiation dose-based limits specified in 10 CFR Part 20, "Standards for Protection Against Radiation," and the ALARA criteria in 10 CFR Part 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents." Through these release limits, the NRC places regulatory limits on the radiation dose that members of the public can receive from a nuclear power plant's radioactive effluent. Energy Harbor uses its ODCM, which contains the methods and parameters for calculating offsite doses resulting from liquid and gaseous radioactive effluents. These methods ensure that radioactive material discharges from PNPP meet NRC and EPA regulatory dose standards.

PNPP's annual radioactive effluent release reports contain a detailed presentation of the releases from PNPP and the resultant calculated doses. Radioactive effluent release data from 2016 through 2021 showed that radiation doses to members of the public were a very small fraction of the limits of NRC's and EPA's radiation protection standards contained in Appendix I to 10 CFR Part 50, 10 CFR Part 20, and 40 CFR Part 190. The annual results for 2017-2021 for the hypothetical maximum individual dose attributable from PNPP effluents was determined to be less than one percent of the total dose an individual living in the PNPP area receives from all sources of manmade and background radiation (EH 2020; EH 2021b; EH 2022c; EH 2022d; FENOC 2017; FENOC 2018; FENOC 2019). The dose calculations from 2020 were the following (EH 2021b):

- maximum individual whole-body dose from liquid effluents was 3.06E-03 millirem (mrem) (0.1 percent of the regulatory limit).
- maximum individual whole-body dose from PNPP gaseous effluents, excluding carbon-14 was 9.24E-07mrem (1.8E-05 percent of the regulatory limit).
- maximum annual individual whole-body dose potentially for carbon-14 is 0.251 mrem/yr (5.109 percent of the limit).

The dose calculations from the 2021 Annual Radiological Environmental Operating Report were the following (EH 2022d):

- maximum individual whole-body dose from liquid effluents was 4.43E-02 mrem (0.15 percent of the regulatory limit).
- maximum individual whole-body dose from PNPP Noble Gas effluents was 1.28E-05 mrem (2.6E-04 percent of the regulatory limit).
- maximum annual individual whole-body dose for carbon-14 was 0.252 mrem/yr (5.0 percent of the limit).

PNPP's Radiological Environmental Monitoring Plan (REMP) provides additional assurance that there are no significant dose or radiological environmental impacts due to operation of the plant. The REMP measures the aquatic, terrestrial, and atmospheric environment for ambient radiation and radioactivity. Monitoring is conducted for the following: direct radiation, air, drinking water, surface water, vegetation, fish, and shoreline sediment. The REMP results for 2020 and 2021 concluded that there are no discernable trends or increase in radiological parameters when comparing current monitoring results to pre-operational studies. There is no detectable radiological effect on the surrounding environment due to operation of PNPP. (EH 2021b; EH 2022d)

In addition to the REMP, PNPP has an onsite GPP designed to monitor the onsite plant environment. There are sets of three wells installed at four locations. Each set has a shallow well with a depth of approximately 25 feet, a mid-depth well with a depth of approximately 50 feet, and a deep-well of approximately 75 feet in depth. More than 30 piezometers comprise the outdoor piezometers located in four separate transects oriented in the north, south, east, and west directions. These piezometers were installed to monitor the performance of the underdrain system to prevent groundwater hydrostatic pressure buildup on plant structures. As described in Section 3.6.2.4, groundwater samples are collected from the 12 groundwater monitoring wells and 4 outdoor quadrant piezometers twice per year. Nearly all groundwater monitoring results for 2020 and 2021 were less than the analysis instrument's minimal detection level. The maximum level detected in groundwater in 2020 was 382 pCi/L tritium and in 2021 336 pCi/L tritium. Any positive result less than 500 pCi/L is considered as background activity and not due to plant operations. The ODCM reporting level for tritium in an environmental water sample is 20,000 pCi/L, the EPA drinking water standard. (EH 2021b; EH 2022c)

Occupational exposure at nuclear power plants is monitored by the NRC. The 3-year (2017-2019) average occupational dose per individual total effective dose equivalent (TEDE) was 0.228 roentgen equivalent man (rem) for PNPP. The annual TEDE limit is 5 (rems) [10 CFR 20.1201(a)(1)]. The average annual collective dose per reactor for boiling water reactors (BWRs) was 112.714 person-rem. In comparison, PNPP had a 3-year (2017–2019) TEDE collective dose per reactor of 219.544 person-rem. (NRC 2022a)

3.11 Environmental Justice

This section characterizes the population and demographic characteristics, including the identification of minority and low-income individuals, within a 50-mile radius of PNPP.

3.11.1 Regional Population

The GEIS presents a population characterization method based on two factors: "sparseness" and "proximity" (NRC 1996b). Sparseness measures population density and city size within 20 miles of a site and categorizes the demographic information as follows.

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles.
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles.
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles.
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles.

(NRC 1996b)

"Proximity" measures population density and city size within 50 miles and categorizes the demographic information as follows.

Demographic Categories Based on Proximity

		Category
Not close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles.
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles.
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles.
Close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles.

(NRC 1996b)

The GEIS then uses the following matrix to rank the population in the region of the plant as low, medium, or high:

GEIS Sparseness and Proximity Matrix

		Proximity			
		1	**2**	**3**	**4**
Sparseness	**1**	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

(gray)		(white)		(black)
Low Population Area		Medium Population Area		High Population Area

(NRC 1996b, Figure C.1)

The 2020 census population and TIGER/Line data from the U.S. Census Bureau (USCB) were used to determine demographic characteristics in the vicinity of the site (USCB 2022e). The data were processed at the state, county, and census block levels using ArcGIS (USCB 2022b; USCB 2022i; USCB 2022h). Census data include people living in group quarters such as institutionalized and non-institutionalized populations. Examples of institutional populations living in group quarters are correctional institutions (i.e., prisons, jails, and detention centers); nursing homes; mental (psychiatric) hospitals; hospitals or wards for the chronically ill; and juvenile institutions. Examples of non-institutional populations living in group quarters are group homes; college dormitories; military quarters; soup kitchens; shelters for abused women (shelters against domestic violence or family crisis centers); and shelters for children who are runaways, neglected, or without conventional housing. (USCB 2021)

The 2020 census data indicate that approximately 282,921 people live within a 20-mile radius of the PNPP site, which equates to a population density of 225 persons per square mile (USCB 2022h). Based on the GEIS sparseness index, the site is classified as Category 4 with greater than or equal to 120 persons per square mile within 20 miles.

The 2020 census data indicate that approximately 2,264,642 people live within a 50-mile radius of the site, which equates to a population density of 288 persons per square mile (USCB 2022h). Based on the GEIS proximity index, the site is classified as Category 4, greater than or equal to 190 persons per square mile within 50 miles.

As illustrated in the GEIS sparseness and proximity matrix, the combination of "sparseness" Category 4 and "proximity" Category 4 results in the conclusion that PNPP is located in a "High" population area.

The latest permanent population projections for Ohio were obtained from the Ohio Department of Development (OHDD 2022). The latest permanent population projections for Pennsylvania were obtained from the Center for Rural Pennsylvania (CRPA 2022). County-level permanent population values for the counties within a 50-mile radius are shown in Table 3.11-2. Transient data for the State of Ohio was obtained from the Ohio Department of Development, Tourism (ODDT 2022). Transient data for the state of Pennsylvania was obtained from Visit Pennsylvania Tourism (VPAT 2022).

The area within a 50-mile radius of the PNPP site totally or partially includes 10 counties within Ohio and three counties within Pennsylvania (Table 3.11-2). According to the 2020 census, the permanent population (not including transient populations) of the entire 13 counties was 3,784,101 (Table 3.11-2). By 2046, the end of the proposed PNPP operating term, the permanent population (not including transient populations) of the entire 13 counties is projected to be approximately 3,880,268. Based on 2020-2046 population projections, an annual growth rate of approximately 0.1 percent is anticipated for the permanent population in the 13 counties wholly or partially within a 50-mile radius (OHDD 2022, CRPA 2022).

As shown in Table 3.11-2, the total population (including transient populations) of the 13 counties, which are totally or partially included within a 50-mile radius, is projected to be approximately 4,128,644 in 2046. The total population (including transient populations) within the 50-mile radius is projected to be 2,418,123 in 2046. (OHDD 2022; CRPA 2022; USCB 2022h; USCB 2022b; ODDT 2022; VPAT 2022)

PNPP is located in Lake County. As shown in Table 3.11-2, the population of Lake County, Ohio, as reported in the 2020 Census was 232,603. Based on Ohio’s population projection data, Lake County's projected permanent population is expected to decline to 227,410 by 2050. Because the county is in decline the maximum population value for the period between 2020 and 2046 was used which is 232,603, the 2020 population value. Thus, the estimated projected average annual growth rate for Lake County was held to zero growth. (OHDD 2022; USCB 2022b)

Communities with centers falling within a 50-mile radius of PNPP are listed in Table 3.11-1. As seen in Figure 3.1-3, the PNPP site falls within the boundaries of the village of North Perry. The North Perry 2020 population count was reported at 915 persons. Other communities within 6 miles of PNPP include the village of Perry (2020 population count 1,602) and the village of Madison (2020 population count of 3,435). North Madison, Ohio, a census designated place (CDP), had a population of 8,188 in 2020. (USCB 2022i)

As listed in Table 3.11-1, the largest community in Lake County is the city of Mentor (2020 population 47,450), located approximately 14 miles southwest of PNPP. There are two cities within a 50-mile radius of PNPP that have a population greater than 100,000. These cities are Akron (190,469) and Cleveland (372,624). A total of 17 additional communities within a 50-mile radius have populations greater than 25,000 as of 2020 (Table 3.11-1).

3.11.2 Minority and Low-Income Populations

3.11.2.1 Background

The NRC performs environmental justice analyses utilizing a 50-mile radius around the plant as the environmental "impact area." LIC-203 Revision 4 defines a geographic area for comparison as a 50-mile radius (also referred to as "the region" in this discussion) centered on the nuclear plant (NRC 2020b). An alternative approach is also addressed that uses an individual state that encompasses the 50-mile radius individually for comparative analysis as the "geographic area." Both approaches were used to assess the minority and low-income population criteria for PNPP.

LIC-203 guidance suggests using the most recent USCB decennial census data. However, low-income data are collected separately from the decennial census and are available in five-year averages. The 2020 low-income and minority census population data and TIGER/Line data for Ohio and Pennsylvania were obtained from the USCB website and processed using ArcGIS software (USCB 2022j). Census population data were used to identify the minority and low-income populations within a 50-mile radius of PNPP. Environmental justice evaluations for minority and low-income populations are based on the use of USCB block groups for minority and low-income populations.

3.11.2.2 Minority Populations

NRC procedural guidance defines a "minority" population as Black or African American, American Indian, or Alaska Native, Asian, Native Hawaiian/other Pacific Islander, some other race, two or more races, the aggregate of all minority races, Hispanic or Latino ethnicity, and the aggregate of all minority races and Hispanic ethnicity (NRC 2020b). The guidance indicates that a minority population is considered present if either of the following two conditions exists:

1. The minority population in the census block group exceeds 50 percent; or
2. The minority population percentage is more than 20 percent greater in the census block group than the minority percentage of the geographic area chosen for the comparative analysis.

To establish minimum thresholds for each minority category, the non-white minority population total for each state was divided by the total population in the state. This process was repeated with a 50-mile radius total minority population and 50-mile radius total population. As described in the second criterion, 20 percent was added to the minority percentage values for each geographic area. The lower of the two NRC conditions for a minority population was selected as defining a minority area (i.e., census block group minority population exceeds 50 percent, or minority population is more than 20 percent greater than the minority population of the geographic area). Any census block group with a percentage exceeding this value was considered a minority population. Minority percentages for Ohio, Pennsylvania, and a 50-mile radius, and the corresponding criteria, are shown in Table 3.11-3.

A minority category of "Aggregate of All Races" is created when the populations of all the 2020 USCB minority categories are summed. As shown in Table 3.11-3, the 2020 "Aggregate of All

Races" category, when compared to the total population, indicates 28.6 percent of the population in a 50-mile radius (region) are minorities. The "Aggregate of All Races" population percentages for Ohio are 23.0 percent and 25.0 percent for Pennsylvania. None of the percentages exceeded the 50 percent noted for Condition 1, defined above. As such, the criteria calculated using Condition 2 listed in Table 3.11-3 was used for the threshold. Using the alternate approach defined above, where a 50-mile radius is used as the geographic area, any census block group with a combined "Aggregate of All Races" population equal to or greater than 48.6 percent would be considered a minority population. Similarly, the state was evaluated and a series of criteria for each race and low-income category were defined. When the state is used as the geographic area, any census block group with an "Aggregate of All Races" population exceeding 43.0 percent in Ohio and 45.0 percent in Pennsylvania was considered a minority population.

Because Hispanic is not considered a race by the USCB, Hispanics are already represented in the census-defined race categories. However, because Hispanics can be represented in any race category, some white Hispanics not otherwise considered minorities become classified as a minority when categorized in the "Aggregate and Hispanic" category.

The number of census block groups contributing to the minority population count were evaluated using the criteria shown in Table 3.11-3 and summarized in Table 3.11-4. The results of the evaluation are census block groups flagged as having a minority population(s). The resulting maps (Figures 3.11-1, 3.11-2, 3.11-3, 3.11-4, 3.11-5, 3.11-6, 3.11-7, 3.11-8, 3.11-9, 3.11-10, 3.11-11, 3.11-12, 3.11-13, and 3.11-14) depict the location of minority population census block groups flagged accordingly for each race or aggregate category. Because no block group met the criteria for the "American Indian and Alaskan Native" or the "Native Hawaiian/Other Pacific Islander" race categories, no figures illustrating those race categories were produced. The identified minority population block groups are associated with communities or USCB defined areas. (USCB 2022e; USCB 2022j)

The percentage of census block groups exceeding the "Aggregate of All Races" minority population criterion was 27.5 percent when a 50-mile radius (region) was used and 29.4 percent when the individual state was used as the geographic area (Table 3.11-4). For the "Aggregate and Hispanic" category, 28.0 percent of the census block groups contained a minority population when the region was used, and 30.4 percent of the block groups contained minority populations when the individual state was used (Table 3.11-4). The minority population values of the block groups were significantly reduced when races were analyzed individually.

The identified minority population closest to PNPP is located west of Center Rd in Perry TWP (Block Group 390852063004). This census block group contained a total of 966 persons. Using either the individual state criteria or the regional criteria, the block group contains a Hispanic or Latino population. As discussed in Section 3.1, there are no private residences located within the PNPP site boundary. (USCB 2022j; PT 2022a; EH 2021b)

There is an additional identified minority block group within the PNPP vicinity at approximately 6 miles southwest of the site (Block Group 390852042002). This census block group contained a total of 1,495 persons. Using either the individual state criteria or the regional criteria, the block group contains the following minority populations: Some Other Race, Aggregate of all Races, Hispanic or Latino, and Aggregate and Hispanic. (USCB 2022j)

As presented in Section 3.1.3, there are no federal or state recognized native American Indian tribes with reservations or identified lands located in the 50-mile region.

3.11.2.3 Low-Income Populations

NRC guidance defines "low-income" using USCB statistical poverty thresholds for individuals or families (NRC 2020b). As addressed above with minority populations, two alternative geographic areas (Ohio and Pennsylvania individually and the 50-mile region) were used as the geographic areas for comparison in this analysis. The guidance indicates that a low-income population is considered present if either of the two following conditions exists:

1. The low-income population in the census block group exceeds 50 percent; or
2. The percentage of households below the poverty level in a block group is significantly greater (typically at least 20 percent) than the low-income population percentage of the geographic area chosen for the comparative analysis (i.e., individual state and region's combined average).

To establish minimum thresholds for the individual low-income category, the population with an income below the poverty level for the state was divided by the total population for whom poverty status is determined in the state. To establish minimum thresholds for the family low-income category, the family population count with an income below the poverty level for the state was divided by the total family population count in the state. This process was repeated for the regional population with an income below the poverty level and regional total population for whom poverty status is determined. As described in Condition 2, above, 20 percent was added to the low-income values for individuals and families and each geographic area. None of the geographic areas described in the first condition exceeded 50 percent.

As shown in Table 3.11-5, when the 2016-2020 census data category "income in the past 12 months below poverty level" (individual) is compared to "total population for whom poverty status is determined," 14.1 percent of the population in the region has an individual income below poverty level. In Ohio, the percentage of individuals with an income below poverty level is 13.6. In Pennsylvania, the percentage of individuals with an income below poverty level is 12.0.

As shown in Table 3.11-5, Ohio has an estimated 630,958 families living below poverty level while Pennsylvania has 602,145. When the 2016-2020 census data family category "income in the past 12 months below poverty level" is compared to "total family count," 14.2 percent of the families within the region has an income below poverty level. In Ohio and Pennsylvania, the percentage of the family population with an income below poverty level is 13.4 and 11.8 percent, respectively.

As an example of calculating the criteria, when the region is used as the geographic area, any census block group within a 50-mile radius with populations of low-income individuals equal to or greater than 34.1 (14.1 + 20) percent of the total block group population would be considered a "low-income population." Using this criterion, 273 of the 1,993 census block groups

(13.7 percent) were identified as low-income populations within a 50-mile radius of the PNPP site, as shown in Figure 3.11-15. (USCB 2022j)

When Ohio is used as the geographic area, any census block group within the Ohio portion of the region with a low-income (individual) population equal to or greater than 33.6 percent of the total block group, the population would be considered a "low-income population" (individual) (Table 3.11-5). Similarly for the Pennsylvania portion of the region, any census block group within the Pennsylvania portion of the region with a low-income (individual) population equal to or greater than 32.0 percent of the total block group, the population would be considered a "low-income population" (individual). Using this criterion, 276 of the total 1,993 census block groups (13.8 percent) have low-income individual population percentages that meet or exceed the threshold criteria noted in Table 3.11-6. These census block groups are illustrated in Figure 3.11-16.

Similarly, these criteria are calculated using both geographic areas and family census counts (Table 3.11-6). Using the family individual state criteria, 254 census block groups were identified as having low-income families. Using the family regional criteria, 239 census block groups were identified as having low-income families (Table 3.11-6). These census block groups are illustrated in Figures 3.11-17 and 3.11-18. (USCB 2022j) The closest low-income block group that meets the guidance criteria for individuals or families is located 6 miles southwest of the PNPP center point (Block Group 390852042002). (USCB 2022j)

There are 60 identified low-income population block groups located in, partially within, or adjacent to USCB-defined urban areas. This leaves one block group that is not associated with an urban area. The Block Group falls approximately 22 miles south-southeast of the site. (USCB 2022e; USCB 2022j)

3.11.3 Subsistence Populations and Migrant Workers

3.11.3.1 Subsistence Populations

Subsistence refers to the use of natural resources as food for consumption and for ceremonial and traditional cultural purposes, usually by low-income or minority populations. Specific examples of subsistence use include gathering plants for direct consumption (rather than produced for sale from farming operations), for use as medicine, or in ritual practices. Fishing or hunting activities associated with direct consumption or use in ceremonies, rather than for sport, are other examples.

Determining the presence of subsistence use can be difficult, as data at the county or block group level are aggregated and not usually structured to identify such uses on or near the site. Frequently, the best means of investigating the presence of subsistence use is through dialogue with the local population who are most likely to know of such activity. This may include county officials, community leaders, and landowners in the vicinity who would have knowledge of subsistence activity.

The area surrounding PNPP is largely rural and forested, with scattered residential and small communities. Energy Harbor queried PNPP staff, government organizations with a social welfare mission, and private social welfare organizations to identify whether there are any subpopulations near PNPP (Lake, Ashtabula, and Geauga counties) that engage in a subsistence-like lifestyle. This would include groups in which hunting, gathering, fishing, and gardening constituted a substantially larger fraction of the subpopulation's food sources than those of the general population. No known subsistence-based activity was identified in the PNPP vicinity. However, Amish communities are located throughout Ohio and within the region southeast of the site (ODOT 2022d). The second largest Amish community is located approximately 25 miles south-southeast of the site in Mesopotamia Township, Ohio and may engage in a subsistence-like lifestyle. (TCTB 2022)

Each year a REMP land use census is conducted to assess the contribution of radionuclides to the environment resulting from PNPP operation. The census is conducted by traveling all roads within a 5-mile radius of the plant site and recording and mapping the locations of the nearest resident, available milk animal, and vegetable garden. The results for each sample type are discussed in the publicly available annual radiological environmental operating reports and compared to historical data to determine if there are any observable trends. As discussed in Section 3.10.3, there are no discernable trends or increase in radiological parameters when comparing current monitoring results to pre-operational studies. As such, the REMP program has not identified any significant effects to the environment, therefore no potential impact pathways were identified from PNPP that would have an effect on the Amish population.

3.11.3.2 Migrant Workers

Migrant labor, or a migrant worker, is defined by the USDA as "a farm worker whose employment required travel that prevented the migrant worker from returning to his/her permanent place of residence the same day." In 2017, Lake County reported that 84 out of 214 total farms employed farm labor. An estimated total of 1,593 farm laborers were hired, of which 694 were estimated to work fewer than 150 days per year. (USDA 2022b)

Table 3.11-1 Cities, Boroughs, and Villages Located Totally or Partially within a 50-Mile Radius of PNPP (Sheet 1 of 5)

City/Borough/Village/CDP	County	2010 Census Population[(a)]	2020 Census Population[(b)]	Distance to PNPP (miles)[(c)(d)]	Direction [(c)(d)]
Ohio					
Akron	Summit	199,110	190,469	53	SSW
Andover	Ashtabula	1,145	972	32	ESE
Aquilla	Geauga	340	305	16	S
Ashtabula	Ashtabula	19,124	17,975	19	ENE
Aurora	Portage	15,548	17,239	35	SSW
Avon	Lorain	21,193	24,847	52	WSW
Avon Lake	Lorain	22,581	25,206	50	WSW
Bay Village	Cuyahoga	15,651	16,163	46	WSW
Beachwood	Cuyahoga	11,953	14,040	30	SW
Bedford	Cuyahoga	13,074	13,149	35	SW
Bedford Heights	Cuyahoga	10,751	11,020	33	SW
Bentleyville	Cuyahoga	864	897	30	SSW
Berea	Cuyahoga	19,093	18,545	48	SW
Boston Heights	Summit	1,300	1,402	42	SSW
Bratenahl	Cuyahoga	1,197	1,430	31	SW
Brecksville	Cuyahoga	13,656	13,635	42	SW
Broadview Heights	Cuyahoga	19,400	19,936	44	SW
Brook Park	Cuyahoga	19,212	18,595	44	SW
Brooklyn	Cuyahoga	11,169	11,359	40	SW
Brooklyn Heights	Cuyahoga	1,543	1,519	38	SW
Brunswick	Medina	34,255	35,426	53	SW
Burton	Geauga	1,455	1,407	23	S
Chagrin Falls	Cuyahoga	4,113	4,188	28	SSW
Chardon	Geauga	5,148	5,242	16	SSW
Cleveland	Cuyahoga	396,815	372,624	35	SW
Cleveland Heights	Cuyahoga	46,121	45,312	29	SW
Conneaut	Ashtabula	12,841	12,318	32	ENE
Cortland	Trumbull	7,104	7,105	39	SSE
Craig Beach	Mahoning	1,180	1,076	48	S
Cuyahoga Falls	Summit	49,652	51,114	49	SSW
Cuyahoga Heights	Cuyahoga	638	573	37	SW
East Cleveland	Cuyahoga	17,843	13,792	29	SW
Eastlake	Lake	18,577	17,670	19	WSW
Euclid	Cuyahoga	48,920	49,692	24	SW

Table 3.11-1 Cities, Boroughs, and Villages Located Totally or Partially within a 50-Mile Radius of PNPP (Sheet 2 of 5)

City/Borough/Village/CDP	County	2010 Census Population[a]	2020 Census Population[b]	Distance to PNPP (miles)[c][d]	Direction [c][d]
Fairport Harbor	Lake	3,109	3,108	8	WSW
Fairview Park	Cuyahoga	16,826	17,291	45	WSW
Garfield Heights	Cuyahoga	28,849	29,781	36	SW
Garrettsville	Portage	2,325	2,449	36	S
Gates Mills	Cuyahoga	2,270	2,264	24	SW
Geneva	Ashtabula	6,215	5,924	10	E
Geneva-on-the-Lake	Ashtabula	1,288	916	11	ENE
Girard	Trumbull	9,958	9,603	50	SSE
Glenwillow	Cuyahoga	923	994	35	SSW
Grand River	Lake	399	394	8	WSW
Highland Heights	Cuyahoga	8,345	8,719	24	SW
Highland Hills	Cuyahoga	1,130	662	31	SW
Hiram	Portage	1,406	996	34	S
Hudson	Summit	22,262	23,110	42	SSW
Hunting Valley	Cuyahoga	705	763	25	SSW
Independence	Cuyahoga	7,133	7,584	39	SW
Jefferson	Ashtabula	3,120	3,226	20	ESE
Kent	Portage	28,904	28,215	46	SSW
Kirtland	Lake	6,866	6,937	16	SW
Kirtland Hills	Lake	646	692	15	SW
Lakeline	Lake	226	216	19	WSW
Lakewood	Cuyahoga	52,131	50,942	40	WSW
Linndale	Cuyahoga	179	108	41	SW
Lordstown	Trumbull	3,417	3,332	46	SSE
Lyndhurst	Cuyahoga	14,001	14,050	26	SW
Macedonia	Summit	11,188	12,168	39	SSW
Madison	Lake	3,184	3,435	5	ESE
Mantua	Portage	1,043	1,001	36	S
Maple Heights	Cuyahoga	23,138	23,701	34	SW
Mayfield	Cuyahoga	3,460	3,356	23	SW
Mayfield Heights	Cuyahoga	19,155	20,351	25	SW
McDonald	Trumbull	3,263	3,172	49	SSE
Mentor	Lake	47,159	47,450	14	SW
Mentor-on-the-Lake	Lake	7,443	7,131	13	WSW

Table 3.11-1 Cities, Boroughs, and Villages Located Totally or Partially within a 50-Mile Radius of PNPP (Sheet 3 of 5)

City/Borough/Village/CDP	County	2010 Census Population[(a)]	2020 Census Population[(b)]	Distance to PNPP (miles)[(c)(d)]	Direction [(c)(d)]
Middleburg Heights	Cuyahoga	15,946	16,004	46	SW
Middlefield	Geauga	2,694	2,748	24	S
Moreland Hills	Cuyahoga	3,320	3,466	28	SSW
Munroe Falls	Summit	5,012	5,044	48	SSW
Newburgh Heights	Cuyahoga	2,167	1,862	36	SW
Newton Falls	Trumbull	4,795	4,557	43	SSE
Niles	Trumbull	19,266	18,443	47	SSE
North Kingsville	Ashtabula	2,923	2,742	24	ENE
North Madison	Lake	8,547	8,188	2	ENE
North Olmsted	Cuyahoga	32,718	32,442	48	WSW
North Perry	Lake	893	915	0	
North Randall	Cuyahoga	1,027	954	32	SW
North Royalton	Cuyahoga	30,444	31,322	45	SW
Northfield	Summit	3,677	3,541	37	SSW
Oakwood	Cuyahoga	3,667	3,572	36	SSW
Olmsted Falls	Cuyahoga	9,024	8,582	49	SW
Orange	Cuyahoga	3,323	3,421	30	SW
Orwell	Ashtabula	1,660	1,533	23	SE
Painesville	Lake	19,563	20,312	7	SW
Parma	Cuyahoga	81,601	81,146	41	SW
Parma Heights	Cuyahoga	20,718	20,863	43	SW
Peninsula	Summit	565	536	44	SSW
Pepper Pike	Cuyahoga	5,979	6,796	28	SW
Perry	Lake	1,663	1,602	3	S
Ravenna	Portage	11,724	11,323	45	S
Reminderville	Summit	3,404	5,412	34	SSW
Richfield	Summit	3,648	3,729	46	SW
Richmond Heights	Cuyahoga	10,546	10,801	26	SW
Roaming Shores	Ashtabula	1,508	1,586	20	ESE
Rock Creek	Ashtabula	529	667	18	ESE
Rocky River	Cuyahoga	20,213	21,755	42	WSW
Seven Hills	Cuyahoga	11,804	11,720	39	SW
Shaker Heights	Cuyahoga	28,448	29,439	30	SW
Silver Lake	Summit	2,519	2,516	47	SSW

Table 3.11-1 Cities, Boroughs, and Villages Located Totally or Partially within a 50-Mile Radius of PNPP (Sheet 4 of 5)

City/Borough/Village/CDP	County	2010 Census Population(a)	2020 Census Population(b)	Distance to PNPP (miles)(c)(d)	Direction (c)(d)
Solon	Cuyahoga	23,348	24,262	32	SSW
South Euclid	Cuyahoga	22,295	21,883	27	SW
South Russell	Geauga	3,810	3,972	28	SSW
Stow	Summit	34,837	34,483	47	SSW
Streetsboro	Portage	16,028	17,260	40	SSW
Strongsville	Cuyahoga	44,750	46,491	49	SW
Sugar Bush Knolls	Portage	177	217	42	SSW
Tallmadge	Summit	17,537	18,394	51	SSW
Timberlake	Lake	675	629	18	WSW
Twinsburg	Summit	18,795	19,248	37	SSW
University Heights	Cuyahoga	13,539	13,914	29	SW
Valley View	Cuyahoga	2,034	1,897	37	SW
Waite Hill	Lake	471	543	18	SW
Walton Hills	Cuyahoga	2,281	2,033	37	SW
Warren	Trumbull	41,557	39,201	42	SSE
Warrensville Heights	Cuyahoga	13,542	13,789	32	SW
West Farmington	Trumbull	499	542	30	SSE
Westlake	Cuyahoga	32,729	34,228	47	WSW
Wickliffe	Lake	12,750	12,652	21	SW
Willoughby	Lake	22,268	23,959	18	SW
Willoughby Hills	Lake	9,485	10,019	20	SW
Willowick	Lake	14,171	14,204	20	SW
Windham	Portage	2,209	1,666	39	S
Woodmere	Cuyahoga	884	641	29	SW
Yankee Lake	Trumbull	79	75	47	SE
Pennsylvania					
Albion	Erie	1,516	1,528	41	E
Conneaut Lake	Crawford	653	624	45	ESE
Conneautville	Crawford	774	739	40	E
Cranesville	Erie	638	570	42	E
Girard	Erie	3,104	2,993	45	ENE
Greenville	Mercer	5,919	5,540	48	SE
Hermitage	Mercer	16,220	16,230	53	SE
Jamestown	Mercer	617	582	43	ESE

Table 3.11-1 Cities, Boroughs, and Villages Located Totally or Partially within a 50-Mile Radius of PNPP (Sheet 5 of 5)

City/Borough/Village/CDP	County	2010 Census Population[a]	2020 Census Population[b]	Distance to PNPP (miles)[c][d]	Direction [c][d]
Lake City	Erie	3,031	2,935	44	ENE
Linesville	Crawford	1,040	962	38	ESE
Orangeville	Mercer	508	479	45	SE
Platea	Erie	430	442	43	ENE
Springboro	Crawford	477	377	40	E

a. and b. (USCB 2022i)

c. (USDOT 2022a)

d. Reported distance and directions were calculated from the PNPP center point to the city center and are approximate. PNPP is located within the boundary of the village of North Perry. North Madison is a CDP and at its closest point is located approximately 2 miles east northeast of the PNPP center point.

Table 3.11-2 County Populations Totally or Partially within a 50-Mile Radius of PNPP

State and County	2010 Population[(a)]	2020 Population[(a)]	2046 Projected Permanent Population[(a)(b)]	2046 Projected Total Population[(a)(b)(c)]
Ohio (10 Counties)	**3,331,072**	**3,318,635**	**3,351,284**	**3,561,070**
Ashtabula	101,497	97,574	97,574	103,682
Cuyahoga	1,280,122	1,264,817	1,264,817	1,343,993
Geauga	93,389	95,397	95,400	101,372
Lake	230,041	232,603	232,603	247,164
Lorain	301,356	312,964	328,190	348,734
Mahoning	238,823	228,614	228,614	242,925
Medina	172,332	182,470	199,890	212,403
Portage	161,419	161,791	161,791	171,919
Summit	541,781	540,428	540,428	574,258
Trumbull	210,312	201,977	201,977	214,620
Pennsylvania (3 Counties)	**485,969**	**465,466**	**528,984**	**567,574**
Crawford	88,765	83,938	88,220	94,656
Erie	280,566	270,876	316,140	339,202
Mercer	116,638	110,652	124,625	133,716

Note: For counties with projected negative population growth the maximum population value for the period between 2020 and 2046 was reported.

a. (USCB 2022b)

b. (OHDD 2022, CRPA 2022)

c. (ODDT 2022, VPAT 2022)

Table 3.11-3 Minority Populations Evaluated Against Criterion

Geographic Area	Ohio[(a)]			Pennsylvania[(a)]			50-Mile Radius (Region)[(a)]		
Total Population	11,799,448			13,002,700			2,351,635		
Census Categories	State Population by Census Category[(a)]	Percent[(b)]	Criteria	State Population by Census Category[(a)]	Percent[(b)]	Criteria	Regional Population by Census Category[(a)]	Percent[(b)]	Criteria
Black or African American	1,478,781	12.5	32.5	1,423,169	10.9	30.9	425,688	18.1	38.1
American Indian or Alaska Native	30,720	0.3	20.3	31,052	0.2	20.2	4,755	0.2	20.2
Asian	298,509	2.5	22.5	510,501	3.9	23.9	63,258	2.7	22.7
Native Hawaiian/Other Pacific Islander	5,034	0.04	20.04	4,276	0.03	20.03	568	0.02	20.02
Some Other Race	224,344	1.9	21.9	508,531	3.9	23.9	48,074	2.0	22.0
Two or More Races	681,372	5.8	25.8	774,484	6.0	26.0	130,750	5.6	25.6
Aggregate of All Races	2,718,760	23.0	43.0	3,252,013	25.0	45.0	673,093	28.6	48.6
Hispanic or Latino	521,308	4.4	24.4	1,049,615	8.1	28.1	114,484	4.9	24.9
Aggregate and Hispanic[(c)]	2,845,313	24.1	44.1	3,449,283	26.5	46.5	698,582	29.7	49.7

a. (USCB 2022j)

b. Percent values were calculated by dividing each census categories' population by the state or region total population values.

c. (NRC 2020b) Includes everyone except persons who identified themselves as White, Not Hispanic or Latino.

Table 3.11-4 Minority Census Block Group Counts, 50-Mile Radius of PNPP

	Individual State Method		50-Mile Radius (Region)	
Total Number of Block Groups with Population within 50-Mile Radius	1,993		1,993	
Census Categories	Number of Block Groups with Identified Minority Category	Percent of Block Groups within 50-mile Radius	Number of Block Groups with Identified Minority Category	Percent of Block Groups within 50-mile Radius
Black or African American	473	23.7	443	22.2
American Indian or Alaska Native	0	0	0	0
Asian	14	0.7	12	0.6
Native Hawaiian/Other Pacific Islander	0	0	0	0
Some Other Race	26	1.3	26	1.3
Two or More Races	5	0.3	5	0.3
Aggregate of All Races	586	29.4	548	27.5
Hispanic or Latino	92	4.6	89	4.5
Aggregate and Hispanic	606	30.4	558	28

(USCB 2022e; USCB 2022j)

Table 3.11-5 Low-Income Population Criteria Using Two Geographic Areas

	Ohio			Pennsylvania			50-Mile Radius (Region)		
(Income) Total Population	11,350,378			12,387,061			2,263,974		
(Income) Total Families	4,717,226			5,106,601			986,053		
Census Category	State Population	Percent	Criteria	State Population	Percent	Criteria	Regional Population	Percent	Criteria
Low Income - Number of Persons Below Poverty Level (Individuals)	1,546,011	13.6	33.6	1,480,430	12.0	32.0	318,373	14.1	34.1
Low Income - Number of Families Below Poverty Level (Households)	630,958	13.4	33.4	602,145	11.8	31.8	140,411	14.2	34.2

(USCB 2022j)
Note: Percent values were calculated by dividing each census categories' population by the state and regional total population values.

Table 3.11-6 Low-Income Census Block Group Counts, 50-Mile Radius of PNPP

	Individual State Method		50-Mile Radius (Region)	
Total Number of Block Groups with Population within 50-mile Radius	1,993		1,993	
Census Categories	Number of Block Groups with Identified Low Income Category	Percent of Block Groups within 50-mile Radius	Number of Block Groups with Identified Low Income Category	Percent of Block Groups within 50-mile Radius
Low Income Individuals	276	13.8	273	13.7
Low Income Families (Households)	254	12.7	239	12

(USCB 2022e; USCB 2022j)

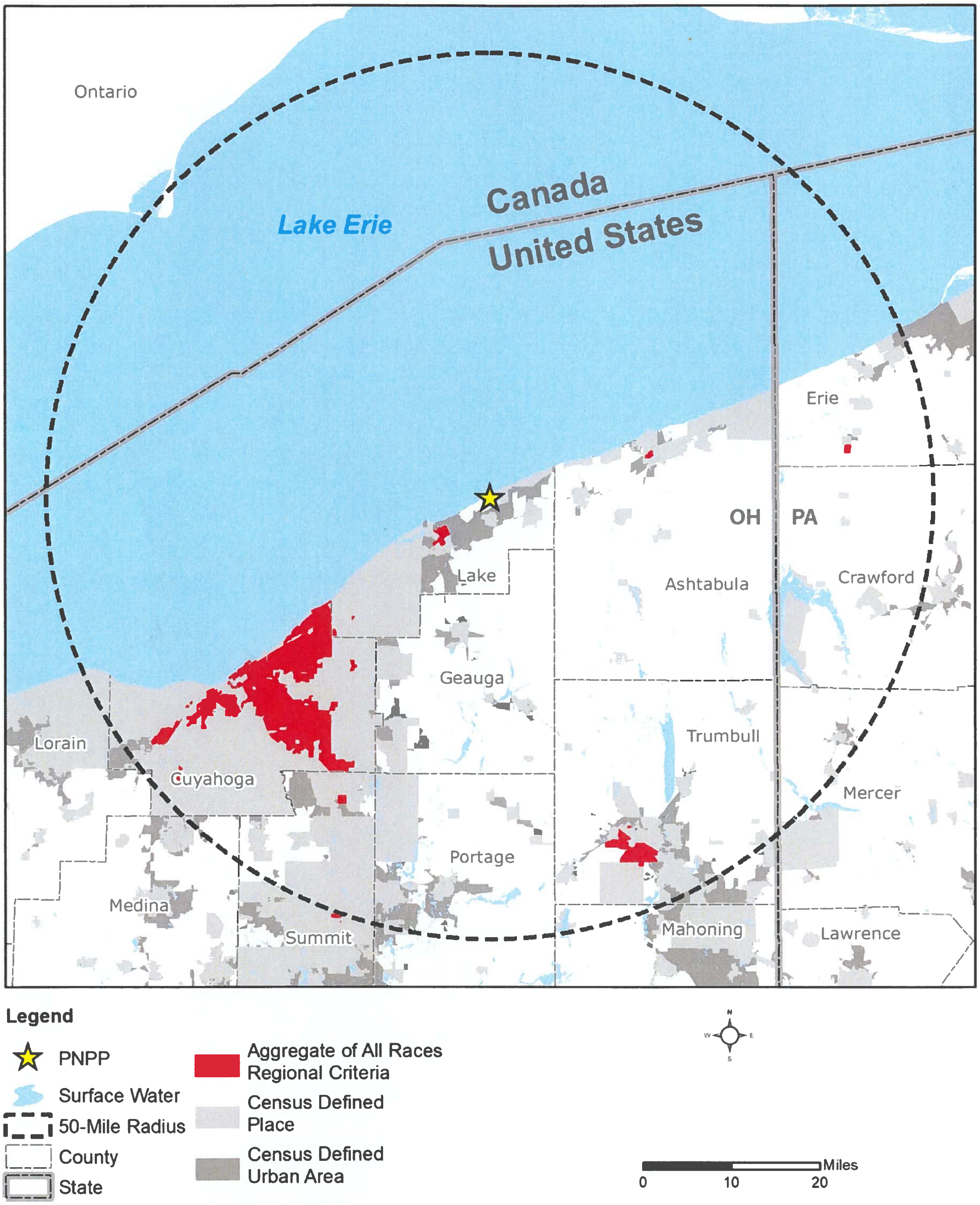


Figure 3.11-1 Aggregate of All Races Populations (Regional)

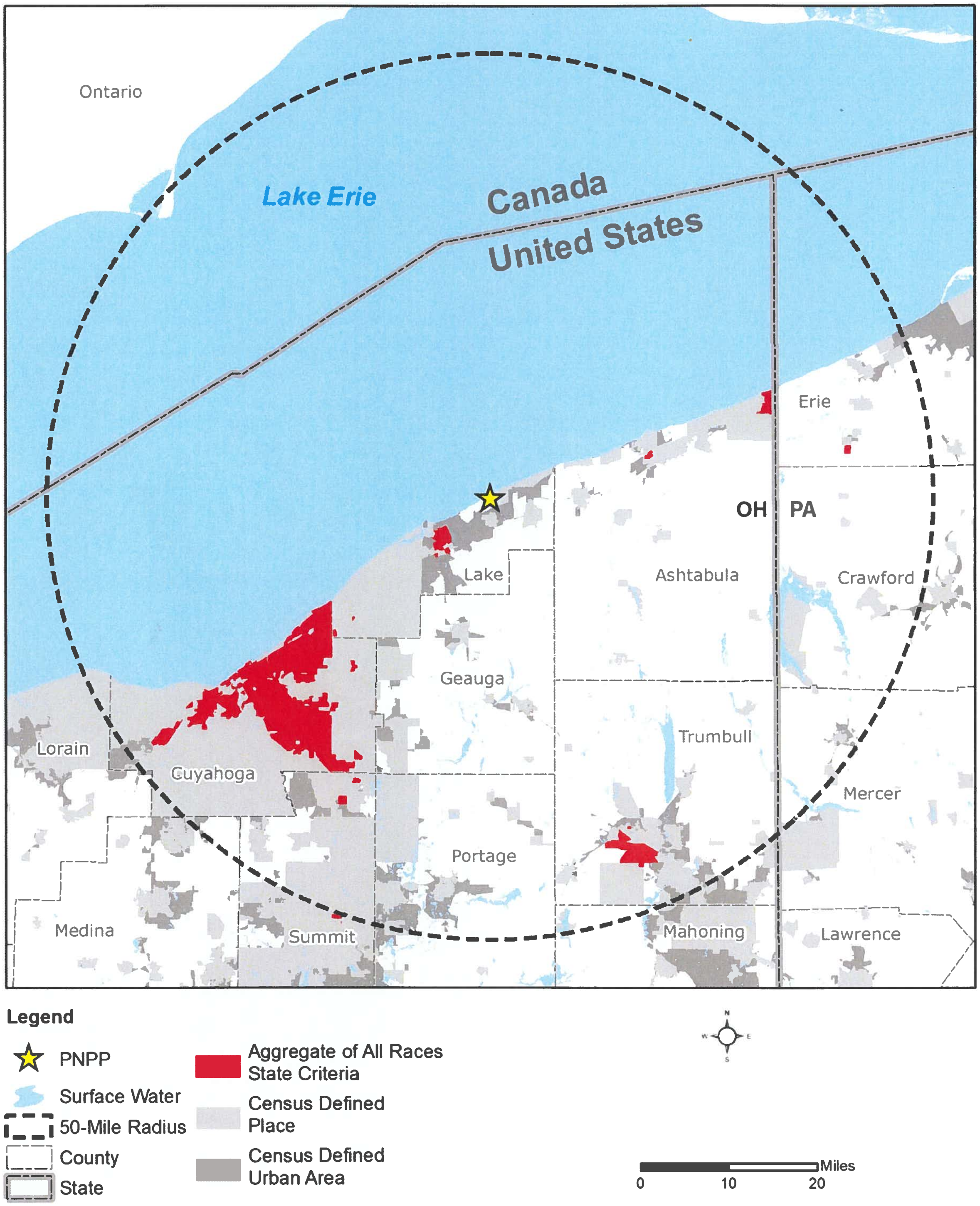


Figure 3.11-2 Aggregate of All Races Populations (Individual State)

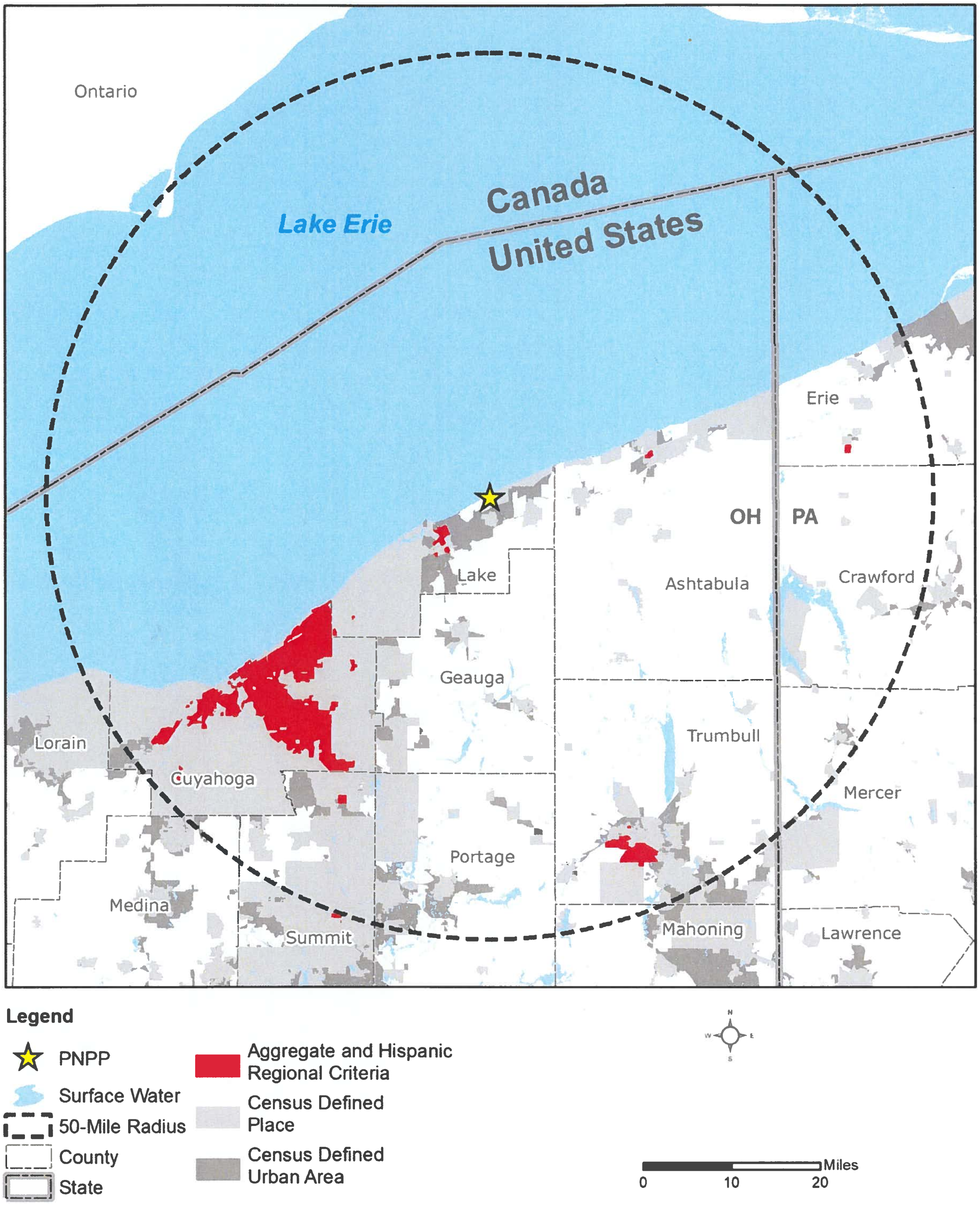


Figure 3.11-3 Aggregate and Hispanic Populations (Regional)

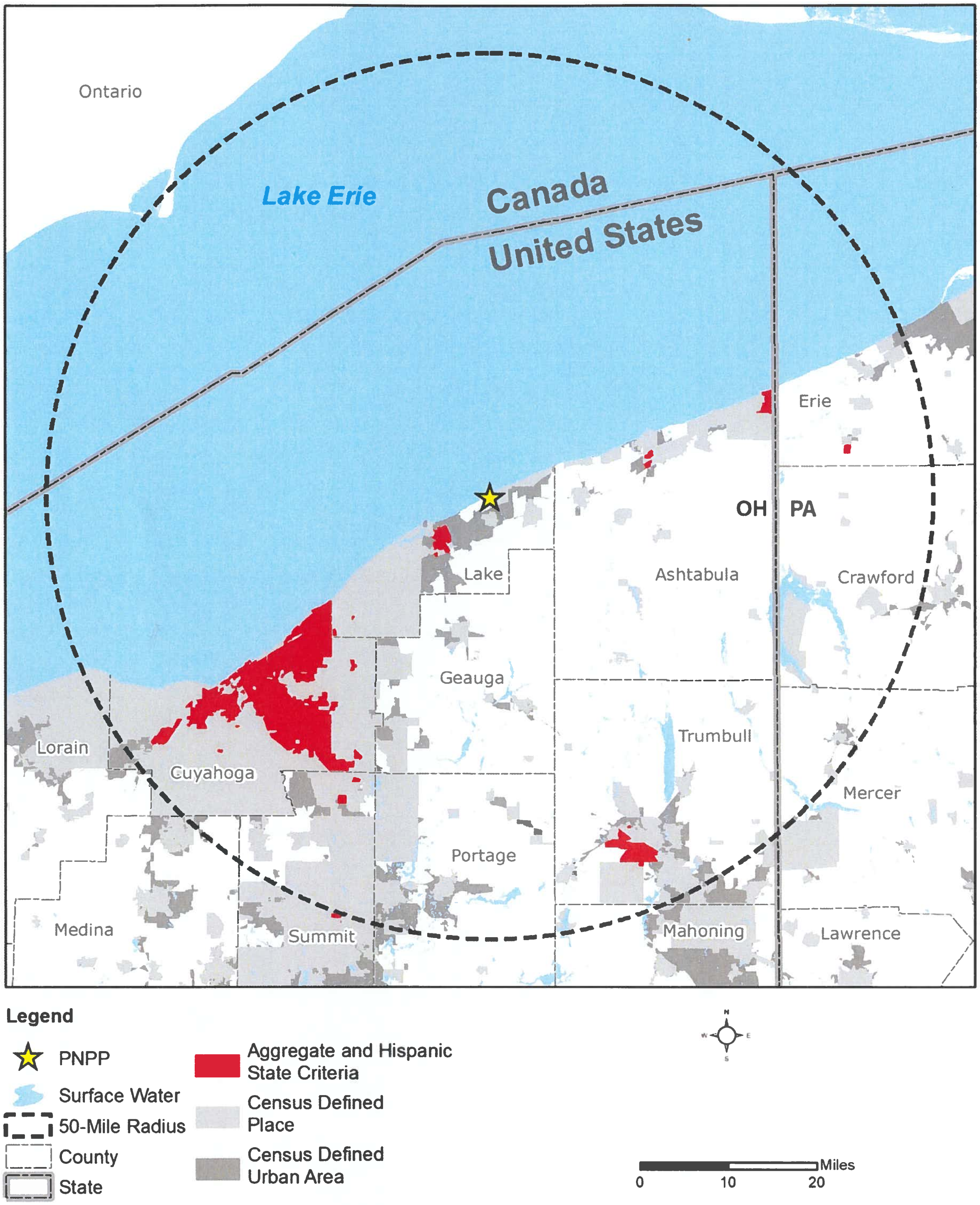


Figure 3.11-4 Aggregate and Hispanic Populations (Individual State)

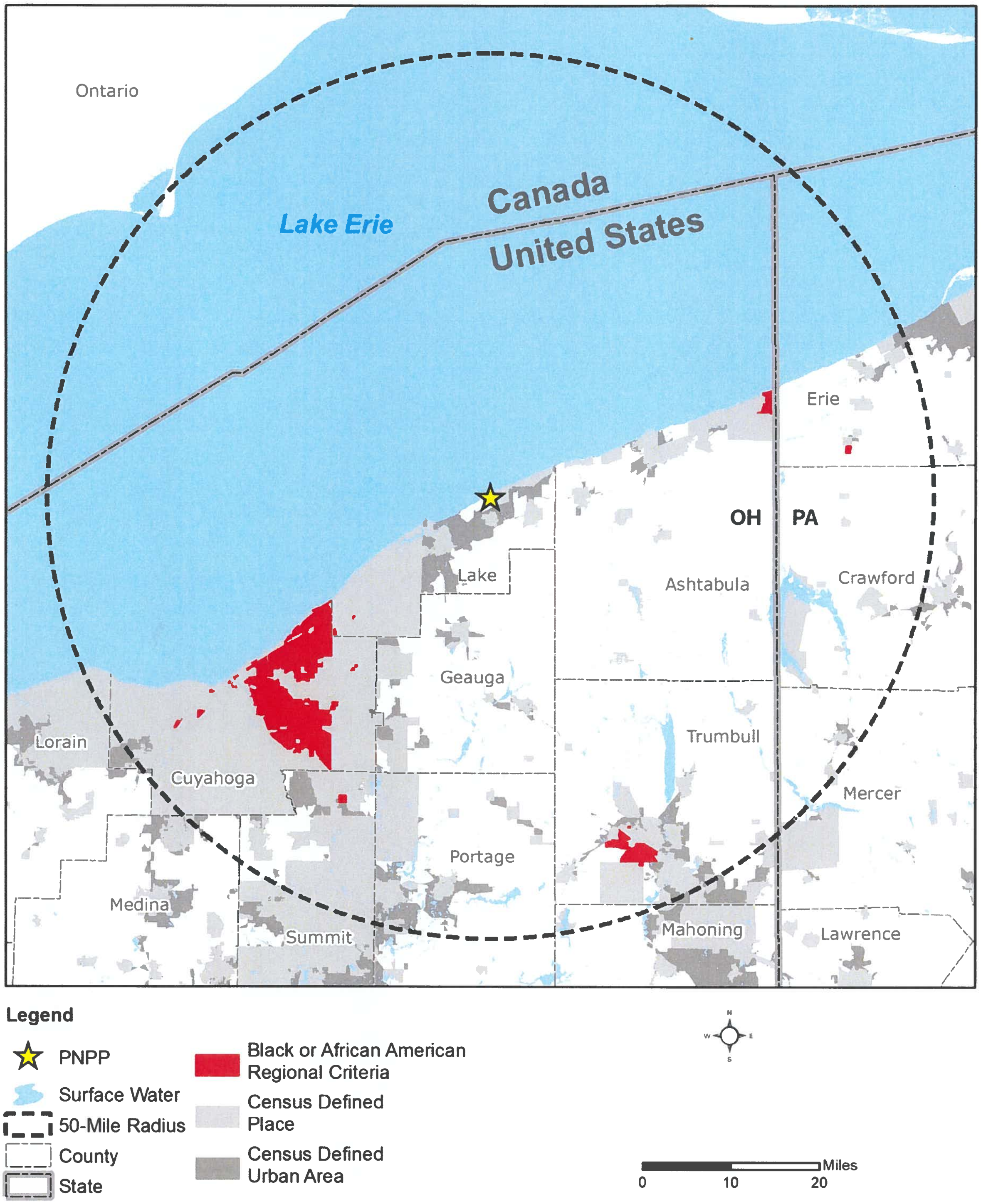


Figure 3.11-5 Black or African American Populations (Regional)

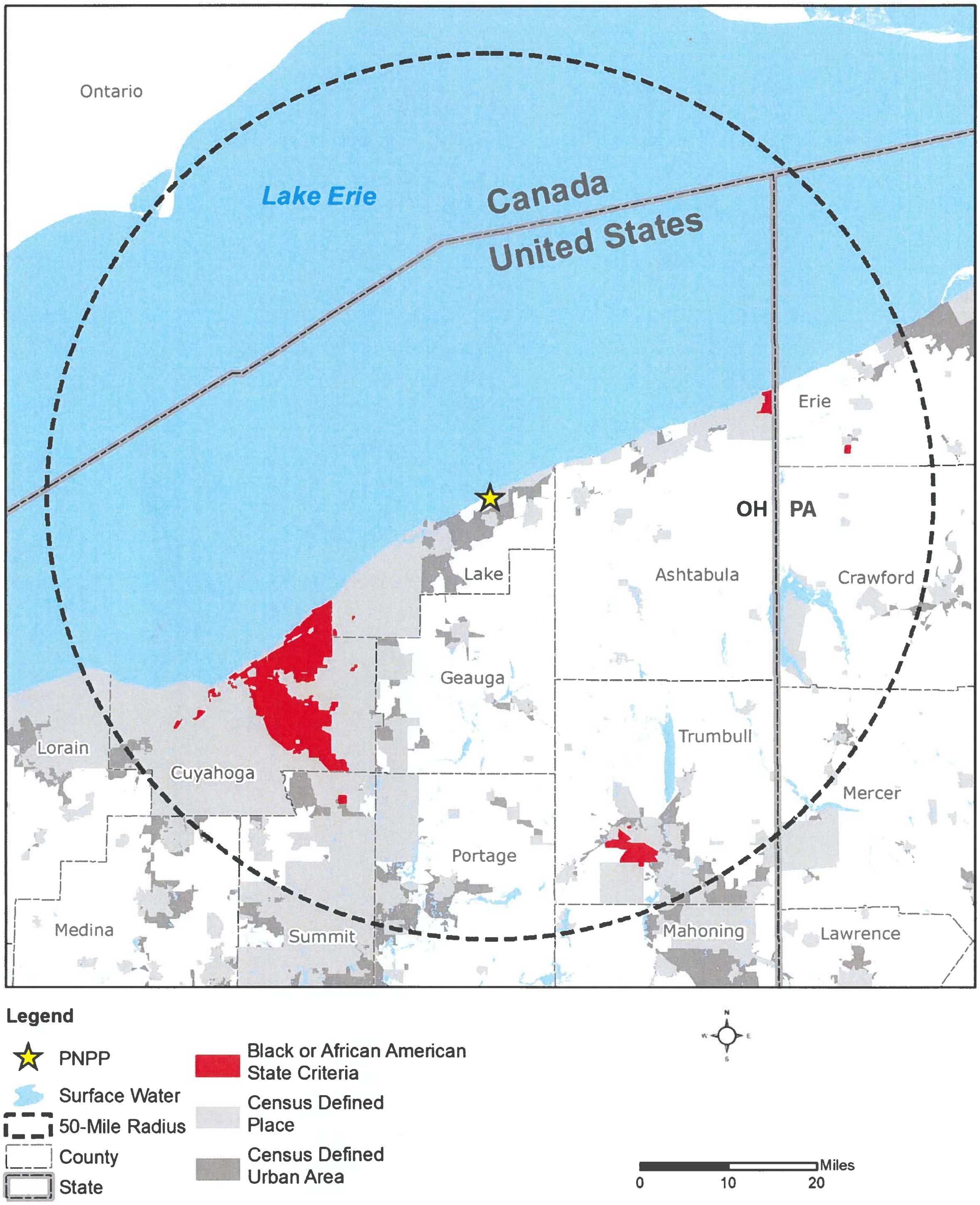


Figure 3.11-6 Black or African American Populations (Individual State)

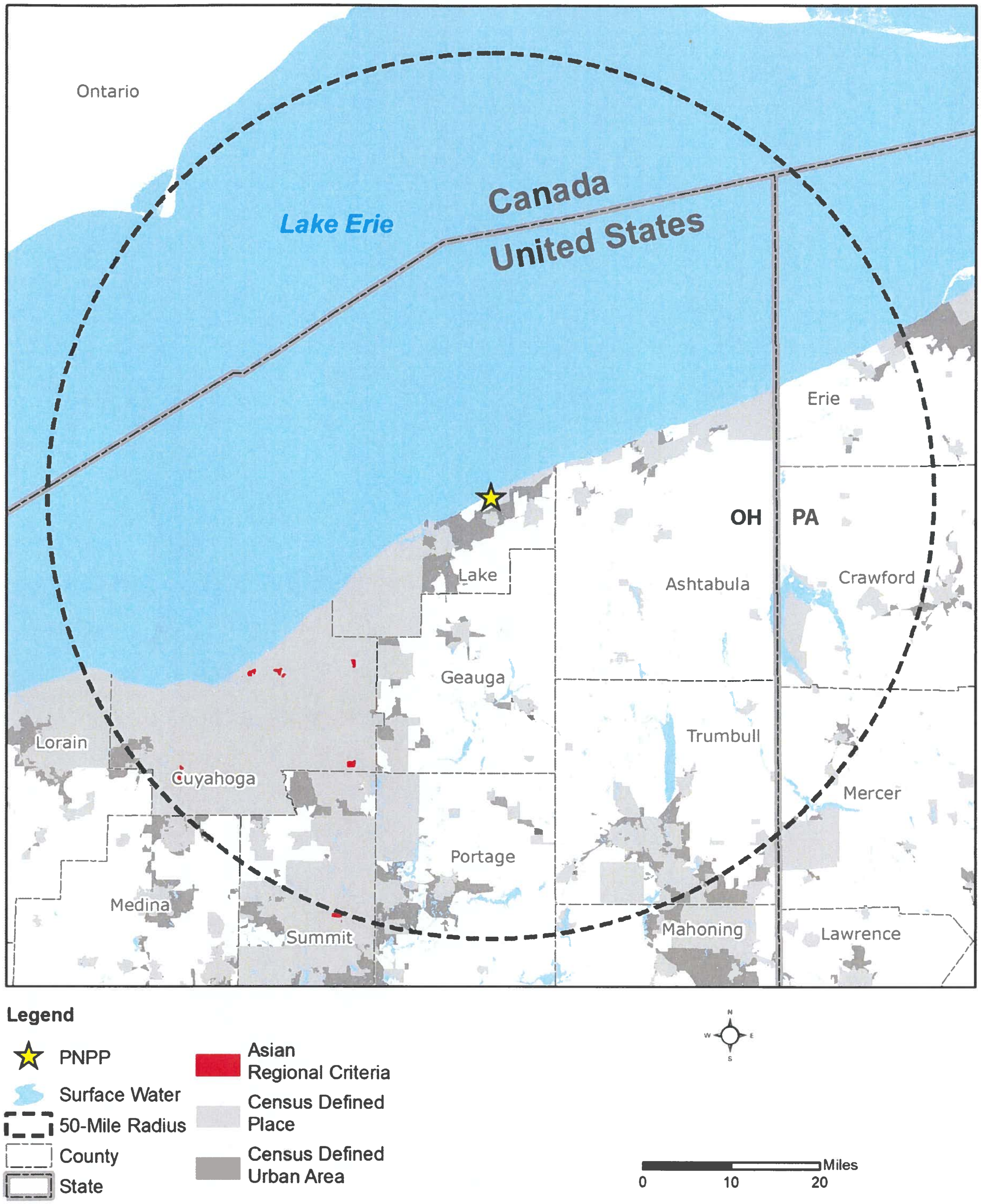


Figure 3.11-7 Asian Populations (Regional)

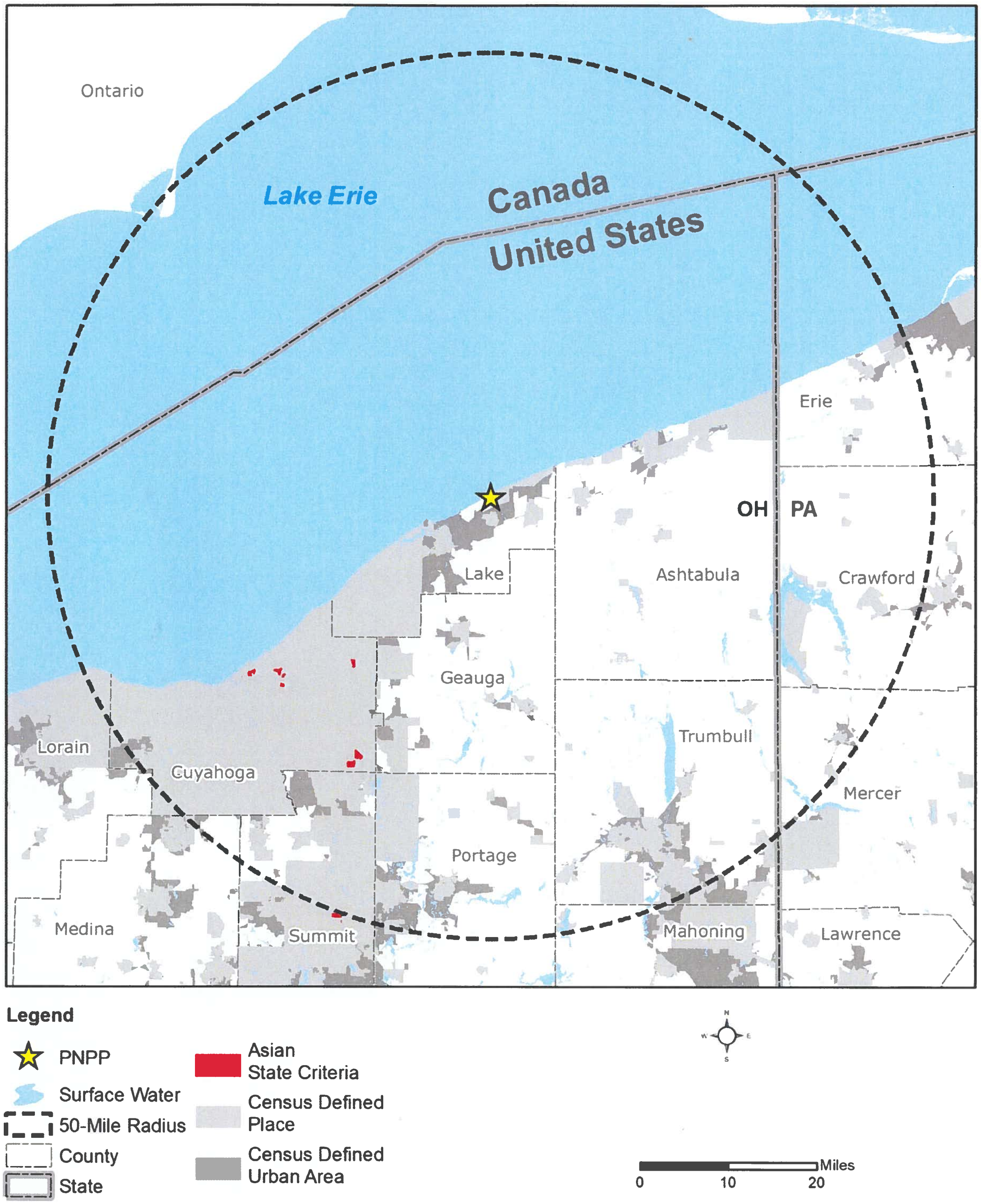


Figure 3.11-8 Asian Populations (Individual State)

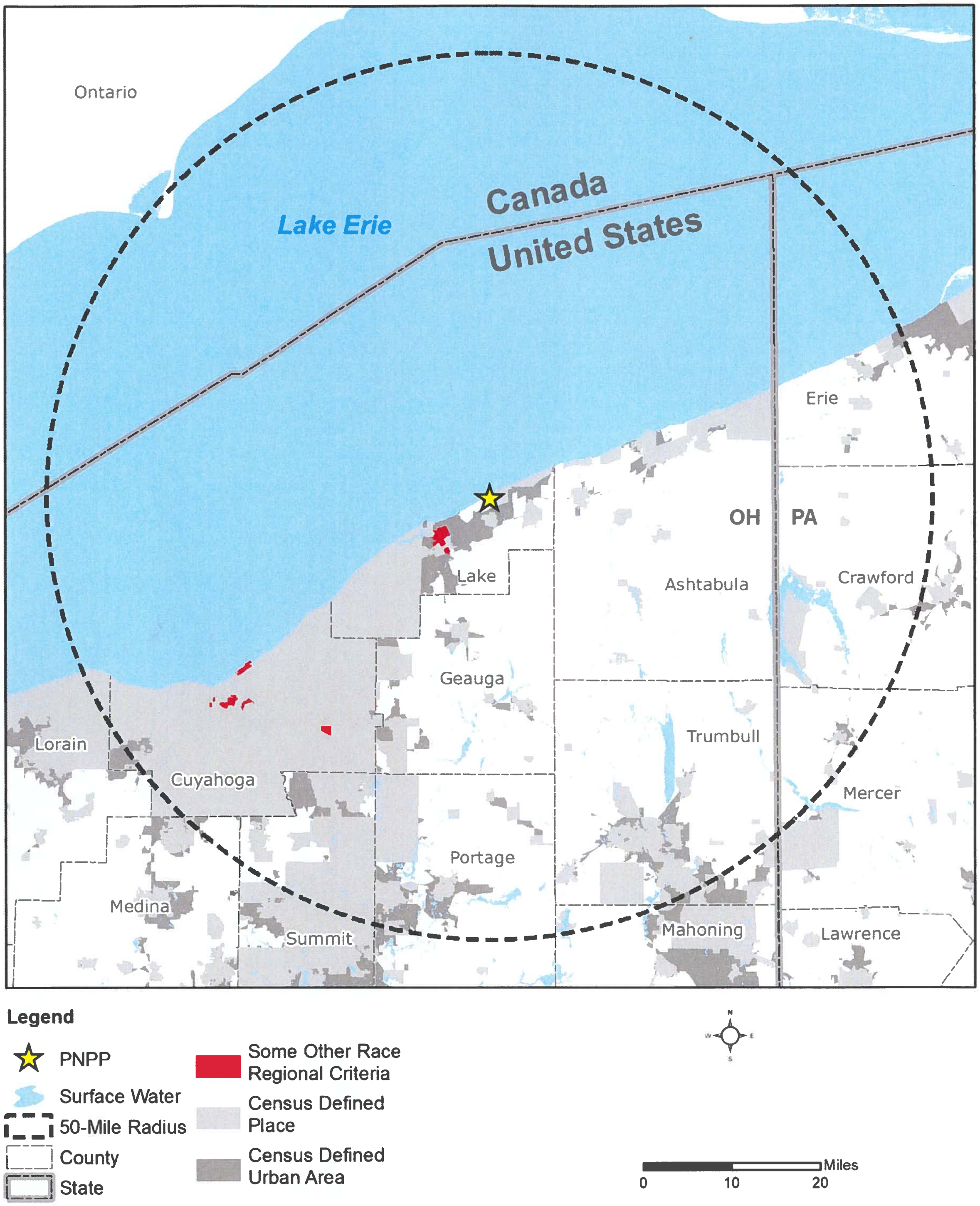


Figure 3.11-9 Some Other Race Populations (Regional)

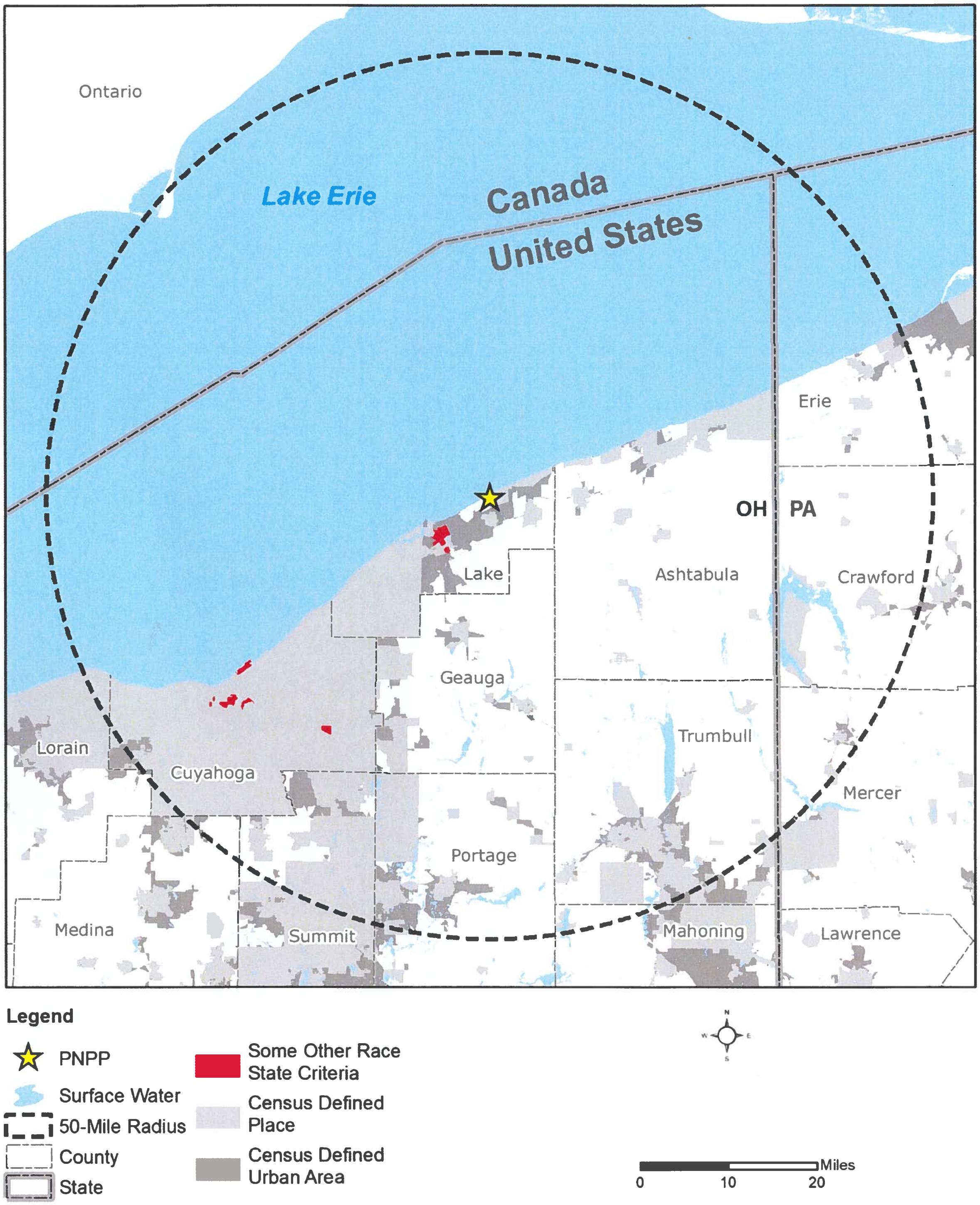


Figure 3.11-10 Some Other Race Populations (Individual State)

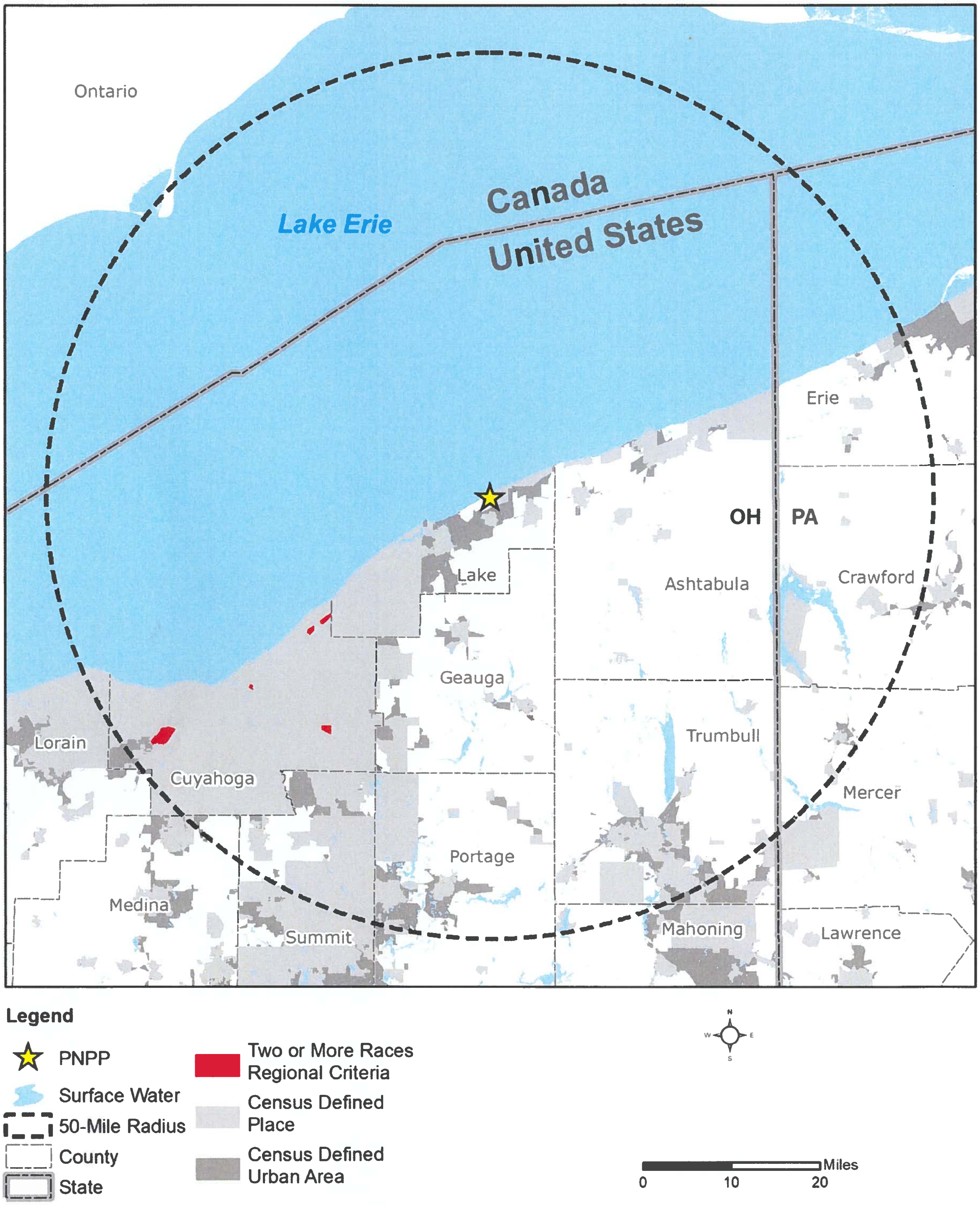


Figure 3.11-11 Two or More Races Populations (Regional)

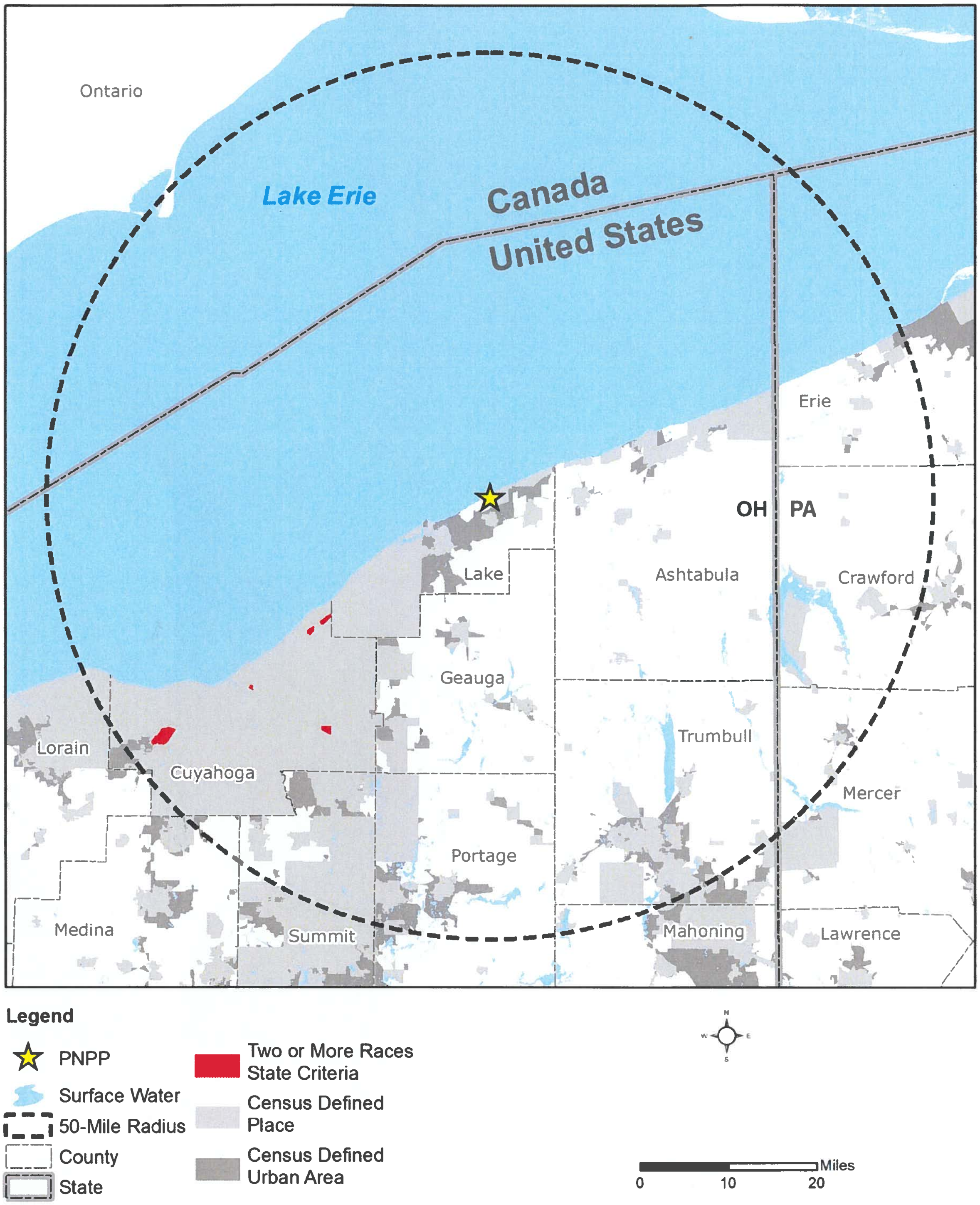


Figure 3.11-12 Two or More Races Populations (Individual State)

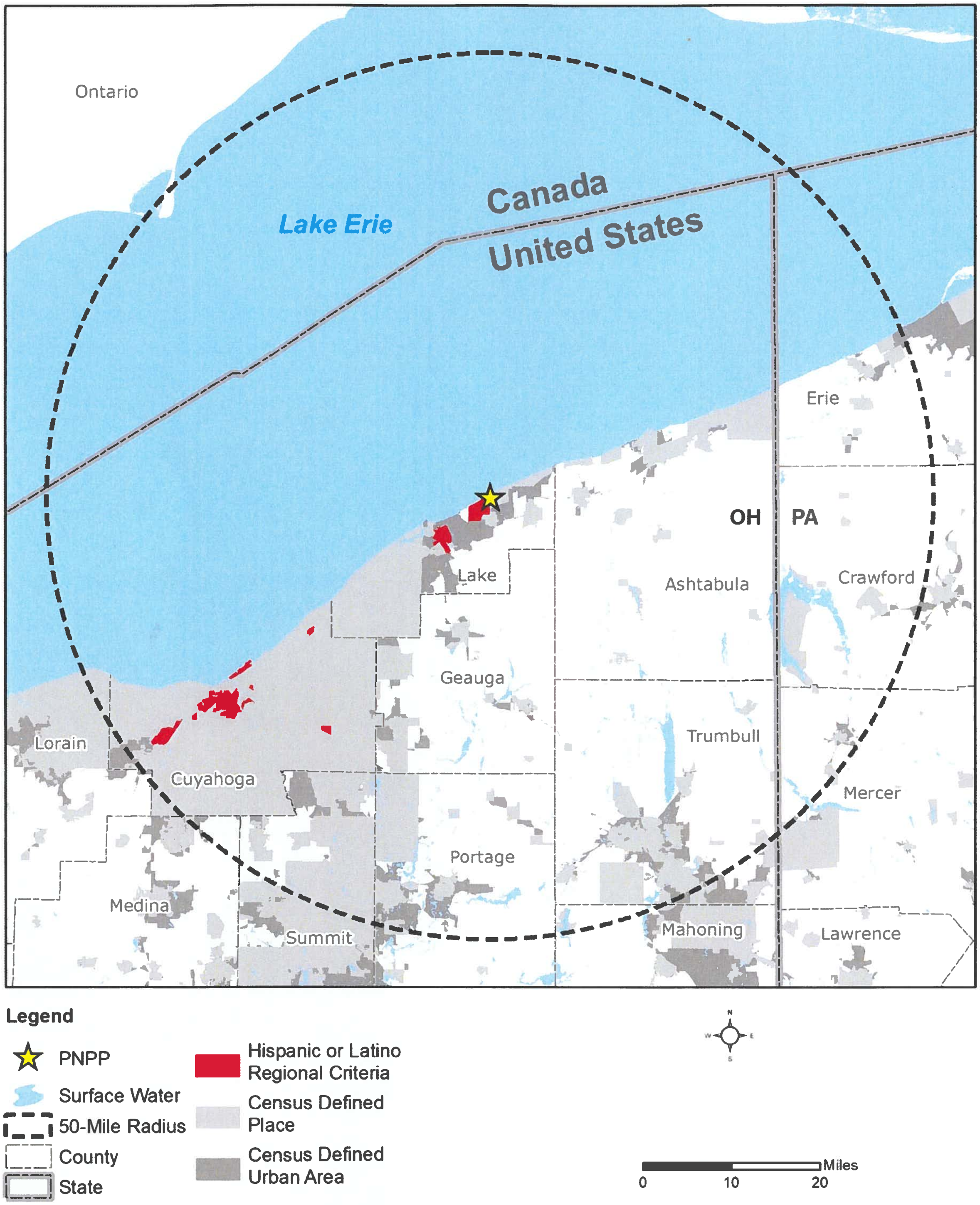


Figure 3.11-13 Hispanic or Latino Populations (Regional)

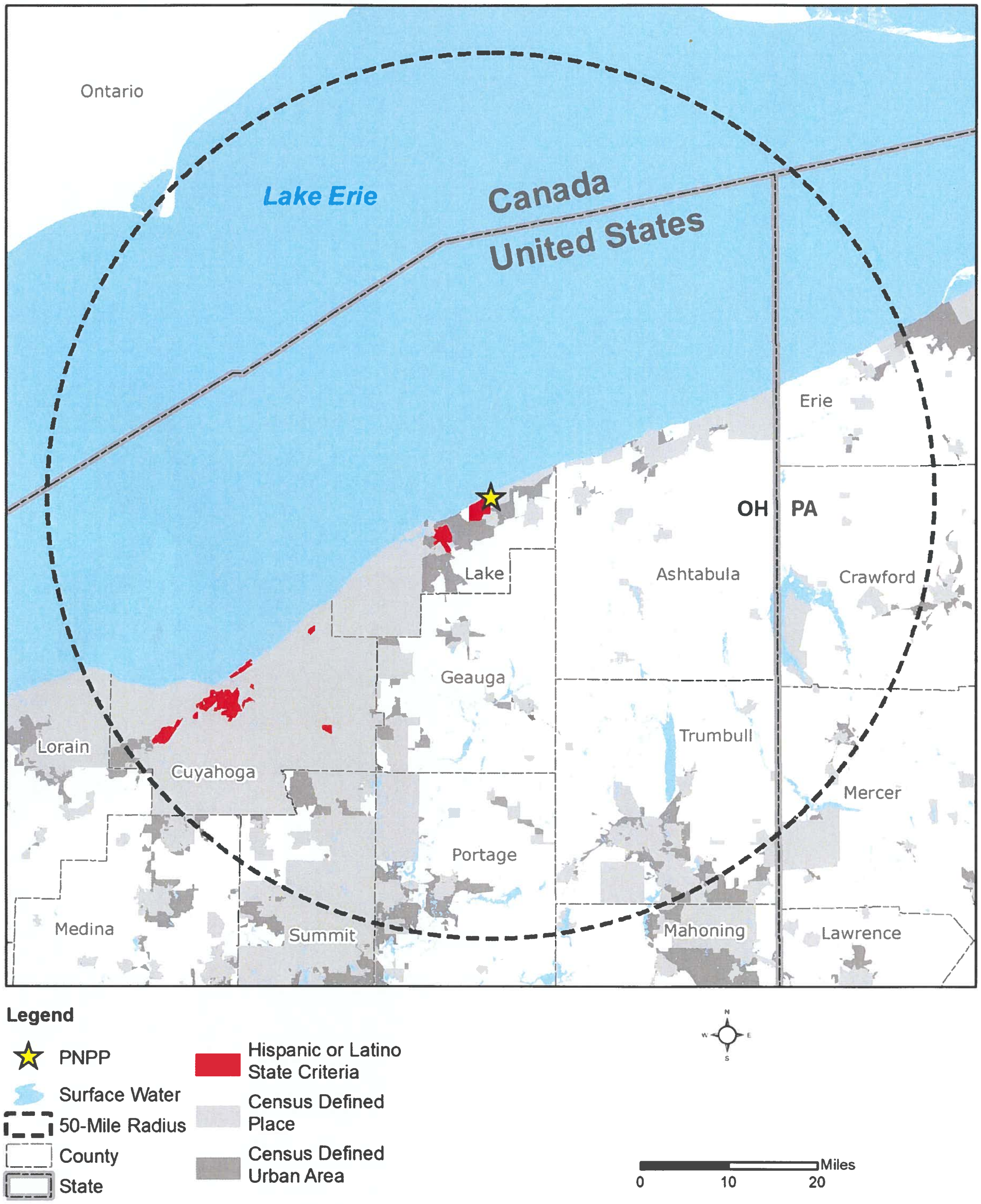


Figure 3.11-14 Hispanic or Latino Populations (Individual State)

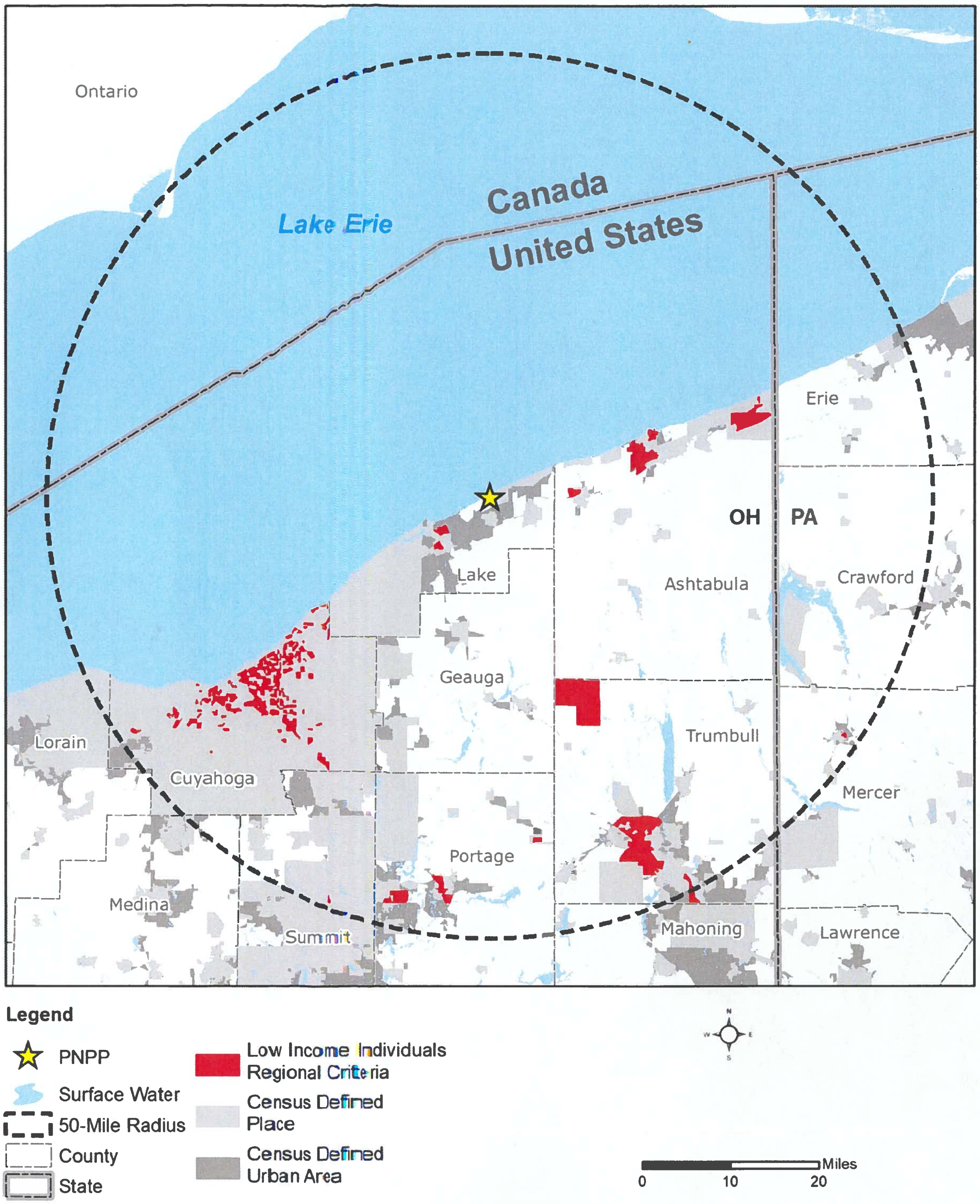


Figure 3.11-15 Low Income Individuals (Regional)

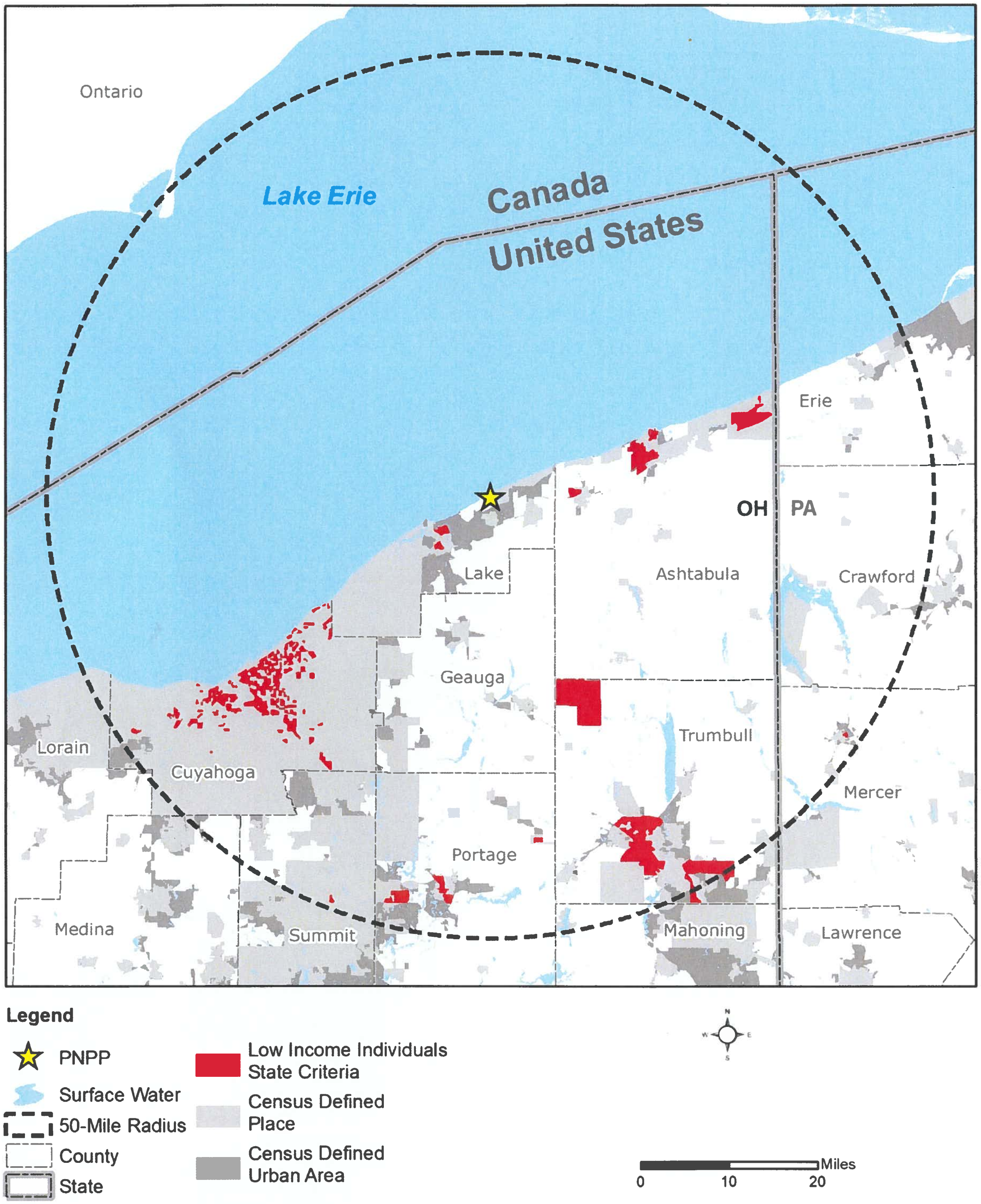


Figure 3.11-16 Low Income Individuals (Individual State)

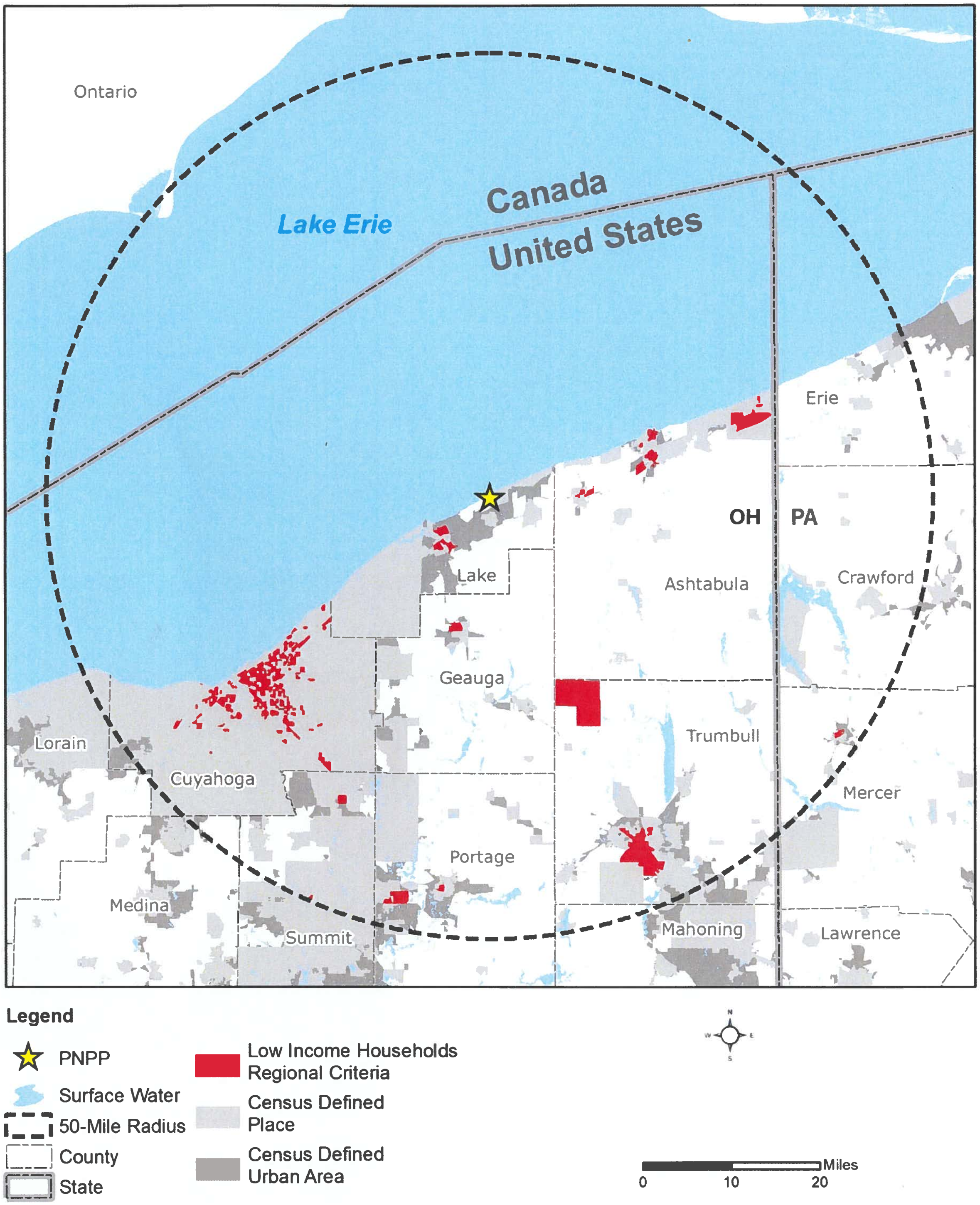


Figure 3.11-17 Low Income Households (Regional)

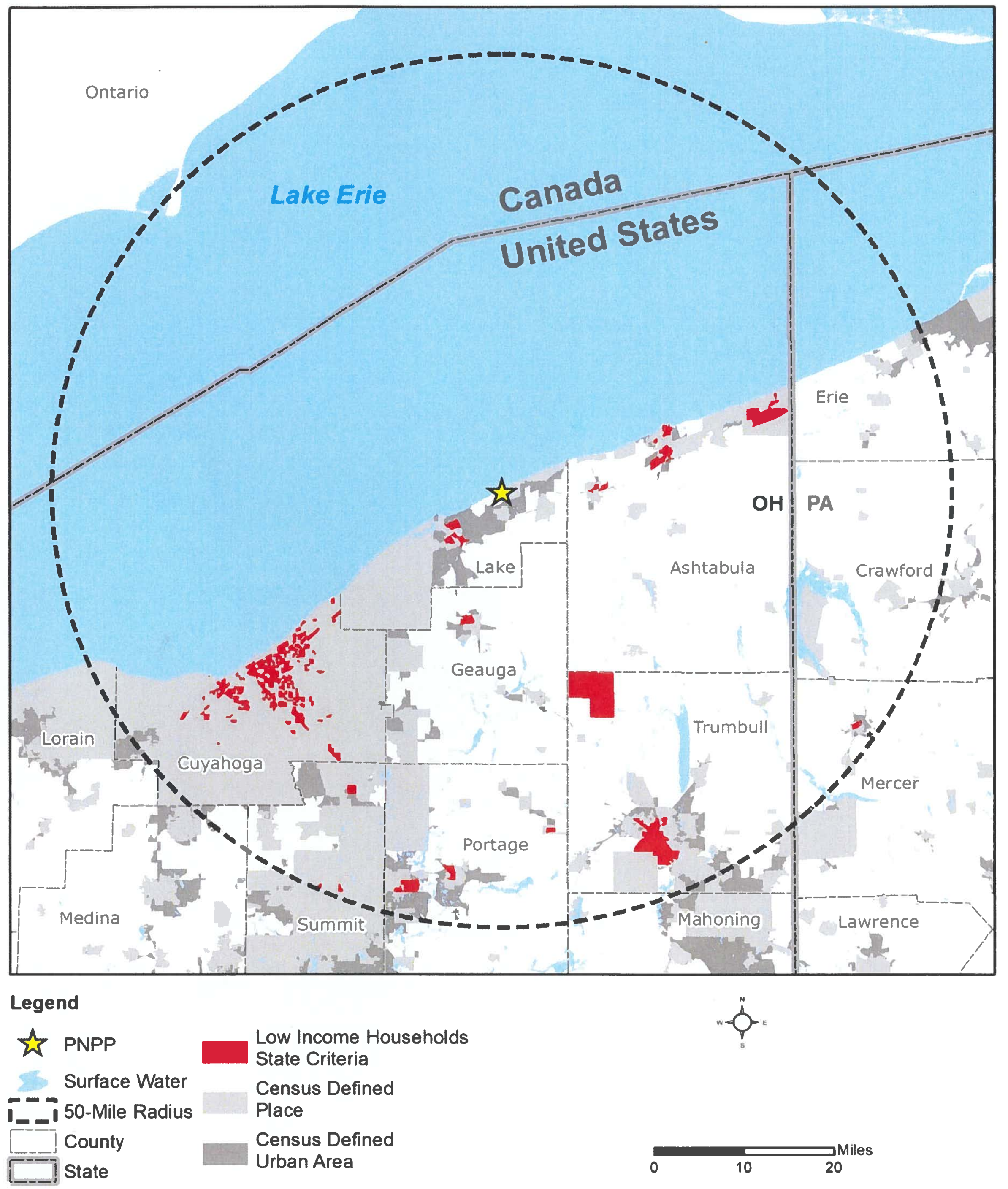


Figure 3.11-18 Low Income Households (Individual State)

3.12 Waste Management

In addressing the plant's radioactive and nonradioactive waste management systems and programs, NRC Regulatory Guide 4.2, Supplement 1, Revision 1, specifies that the information being requested in this section can be incorporated by reference to Section 2.2 of the ER (NRC 2013b). Therefore, consistent with NRC Regulatory Guide 4.2, Energy Harbor is providing the information below to address PNPP's radioactive and nonradioactive waste management systems and program.

3.12.1 Radioactive Waste Management

Section 2.2.6 includes a discussion of PNPP's liquid, gaseous, and solid radwaste systems. The section provides a description of the systems, management of low-level mixed waste, radwaste storage, spent fuel storage, and permitted facilities currently utilized for offsite processing and disposal of radioactive wastes.

3.12.2 Nonradioactive Waste Management

Section 2.2.7 includes a discussion of PNPP's RCRA nonradioactive waste management program, types of wastes generated, waste minimization practices, and permitted facilities currently utilized for disposition of wastes.

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues [10 CFR 51.53(c)(3)(iii)]

> *The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . [10 CFR 51.53(c)(3)(iii)]*
>
> *The environmental report must include an analysis that considers . . . the environmental effects of the proposed action . . . and alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]*
>
> *The environmental report shall . . . discuss . . . the impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance. [10 CFR 51.45(b)(1)]*
>
> *The information submitted . . . should not be confined to information supporting the proposed action but should also include adverse information. [10 CFR 51.45(e)]*

The NRC has identified and analyzed 78 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated these issues as Category 1, Category 2, or uncategorized. The NRC designated an issue as Category 1 if the following criteria were met:

- The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.
- A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for offsite radiological impacts-collective impacts from other than the disposal of spent fuel and high-level waste).
- Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC concluded that one or more of the Category 1 criteria could not be met, the NRC designated the issue Category 2, which requires plant-specific analysis. The NRC designated one issue as uncategorized (chronic effects of electromagnetic fields), signifying that the categorization and impact definitions do not apply to this issue. Until such time that this uncategorized issue is categorized, applicants for license renewal are not required to submit information on this issue [10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 6]; therefore, this issue is not included in Tables 4.0-1, 4.0-2, or 4.0-3, nor is it addressed in Section 4.9. NRC rules do not require analyses of Category 1 issues that were resolved using generic findings [10 CFR 51, Subpart A, Appendix B, Table B-1] as described in the GEIS. Therefore, an applicant may reference the GEIS findings for Category 1 issues, absent new and significant information. The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC. 2013a). In this guidance, new and significant information is defined as follows:

- Information that identifies a significant environmental issue not considered or addressed in the GEIS and consequently, not codified in Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants, in Appendix B, Environmental Effect of Renewing the Operating License of a Nuclear Power Plant, to Subpart A, National Environmental Policy Act-Regulations Implementing Section 102(2), of 10 CFR 51; or
- Information not considered in the assessment of impacts evaluated in the GEIS, leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.
- Further, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

4.0.1 Category 1 License Renewal Issues

The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(i)]

[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal . . . . (61 FR 28483)

Energy Harbor has determined that of the 60 Category 1 issues, seven are not applicable (NA) to PNPP because they result from design or operational features that do not exist at the facility. Table 4.0-1 lists these issues and provides a brief explanation of why they are NA to the site. Table 4.0-2 lists the issues which are applicable to the site. Energy Harbor reviewed the NRC findings on these issues and identified no new and significant information that would invalidate the findings for the site (Chapter 5). Therefore, Energy Harbor adopts by reference the NRC findings for these Category 1 issues.

4.0.2 Category 2 License Renewal Issues

The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with *license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(ii)]*

The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues . . . [10 CFR 1.53(c)(3)(iii)]

The NRC designated 17 issues as Category 2 (Table 4.0-3). Energy Harbor has determined that seven issues are NA to PNPP because they are applicable to plants with a different type of cooling system or to plants with greater groundwater withdrawals. For the 10 issues applicable to the site, the corresponding sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to renewal of the PNPP Unit 1 OL and, when applicable, discuss potential mitigation alternatives to the extent appropriate. With the exception of threatened and endangered species/EFH, historic and cultural resources, and environmental justice, Energy Harbor has identified the significance of the impacts associated with each issue as SMALL, MODERATE, or LARGE, consistent with the criteria that the NRC established in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3 as follows:

SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small.

MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource. For issues where probability is a key consideration (i.e., accident consequences), probability was a factor in determining significance.

Consistent with NRC guidance, Energy Harbor identified the significance of the impacts for the three Category 2 issues of threatened and endangered species/EFH, historic and cultural resources, and environmental justice as follows:

- For threatened and endangered species, the significance of the effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, (1) would have no effect on federally listed species; (2) are not likely to adversely affect federally listed species; (3) are likely to adversely affect federally listed species; or (4) are likely to jeopardize a federally listed species or adversely modify designated critical habitat. For EFH defined under the Magnuson-Stevens Fishery Conservation and Management Act, the significance of effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, would have: (1) no

adverse impact; (2) minimal adverse impact; or (3) substantial adverse impact to the essential habitat of federally managed fish populations. (NRC 2013b)
- For historic and cultural resources (NHPA), the significance of the effects from license renewal can be characterized based on a determination that: (1) no historic properties are present (no effect); (2) historic properties are present but would not be adversely affected (no adverse effect); or (3) historic properties are adversely affected (adverse effect). (NRC 2013a)
- For environmental justice, impacts would be based on disproportionately high and adverse human health and environmental effects on minority and low-income populations. (NRC 2013a)

In accordance with NEPA practice, Energy Harbor considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are SMALL receive less mitigation consideration than impacts that are LARGE).

4.0.3 Not Applicable License Renewal Issues

The NRC determined that its categorization and impact-finding definitions did not apply to chronic effects of electromagnetic fields. Because the categorization and impact finding definitions do not apply as noted in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 5, applicants are not currently required to submit information on this issue.

4.0.4 Format of Issues Reviewed

Chapter 4 follows Regulatory Guide 4.2, Supplement 1, Revision 1 regarding content for the license renewal issues identified in 10 CFR 51, Subpart A, Appendix B, Table B-1 (NRC 2013b). For Category 1 issues, the generic issues resolved by NRC in NUREG-1437, Rev. 1 (NRC 2013a), Energy Harbor presents the results of its new and significant information review. For Category 2 issues which were not resolved in NUREG-1437, Rev. 1, Energy Harbor presents a site-specific analysis. The format for Category 2 issues is described below.

- *Issue:* Title of the issue.
- *Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1:* The findings for the issue from 10 CFR 51, Subpart A, Appendix B, Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants.
- *Requirement:* Restatement of the applicable 10 CFR 51.53 requirement.
- *Background:* A background excerpt from the applicable section of the GEIS. The specific section of the GEIS is referenced for the convenience of the reader.
- *Analysis:* An analysis of the environmental impact, taking into account information provided in the GEIS and 10 CFR 51, Subpart A, Appendix B, as well as current site-specific information. If an issue is NA, the analysis lists the explanation. The analysis section also provides a summary conclusion of the environmental impacts and identifies, as applicable, either ongoing or additional planned mitigation measures to reduce adverse impacts.

Table 4.0-1 Category 1 Issues Not Applicable to PNPP (Sheet 1 of 1)

Issue	Comment
Land Use	
Offsite land use in transmission line rights-of-way (ROWs)	All in-scope transmission lines subject to the evaluation of environmental impacts for license renewal are located completely within the PNPP site boundaries.
Surface Water Resources	
Altered salinity gradients	PNPP does not discharge to an estuary.
Surface water use conflicts (plants with once-through cooling systems)	PNPP does not utilize once-through cooling.
Effects of dredging on surface water quality	PNPP does not conduct maintenance dredging for its cooling water system.
Groundwater Resources	
Groundwater quality degradation (plants with cooling ponds in salt marshes)	PNPP is located on freshwater body and does not utilize cooling ponds.
Terrestrial Resources	
Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	PNPP does not utilize once-through cooling or cooling ponds.
Aquatic Resources	
Effects of dredging on aquatic organisms	PNPP does not conduct maintenance dredging for its cooling water system.

Table 4.0-2 Category 1 Issues Applicable to PNPP (Sheet 1 of 2)

Resource	Issue
Land Use	Onsite land uses
	Offsite land uses
Visual Resources	Aesthetic impacts
Air Quality	Air quality impacts (all plants)
	Air quality effects of transmission lines
Noise	Noise impacts
Geologic Environment	Geology and soils
Surface Water Resources	Surface water use and quality (non-cooling system impacts)
	Altered current patterns at intake and discharge structures
	Scouring caused by discharged cooling water
	Discharge of metals in cooling system effluent
	Discharge of biocides, sanitary wastes, and minor chemical spills
	Temperature effects on sediment transport capacity
Groundwater Resources	Groundwater contamination and use (non-cooling system impacts)
	Groundwater quality degradation resulting from water withdrawals
	Groundwater use conflicts (plants that withdraw less than 100 gallons per minute)
Terrestrial Resources	Exposure of terrestrial organisms to radionuclides
	Cooling tower impacts on vegetation (plants with cooling towers)
	Bird collisions with plant structures and transmission lines
	Transmission line right-of-way management impacts on terrestrial resources
	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)
Aquatic Resources	Impingement and entrainment of aquatic organisms (plants with cooling towers)
	Entrainment of phytoplankton and zooplankton (all plants)
	Thermal impacts on aquatic organisms (plants with cooling towers)
	Infrequently reported thermal impacts (all plants)
	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication
	Effects of non-radiological contaminants on aquatic organisms
	Exposure of aquatic organisms to radionuclides

Table 4.0-2 Category 1 Issues Applicable to PNPP (Sheet 2 of 2)

Resource	Issue
	Effects on aquatic resources (non-cooling system impacts)
	Impacts of transmission line right-of-way management on aquatic resources
	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses
Socioeconomics	Employment and income, recreation and tourism
	Tax revenues
	Community services and education
	Population and housing
	Transportation
Human Health	Radiation exposures to the public
	Radiation exposures to plant workers
	Human health impact from chemicals
	Microbiological hazards to plant workers
	Physical occupational hazards
Postulated Accidents	Design-basis accidents
Waste Management	Low-level waste storage and disposal
	Onsite storage of spent nuclear fuel
	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal
	Mixed-waste storage and disposal
	Non-radioactive waste storage and disposal
Uranium Fuel Cycle	Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste
	Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste
	Non-radiological impacts of the uranium fuel cycle
	Transportation
Termination of Nuclear Power Plant Operations and Decommissioning	Termination of plant operations and decommissioning

Table 4.0-3 Category 2 Issues Applicability to PNPP (Sheet 1 of 2)

Resource Issue	Applicability	ER Section
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.5.1
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute)	Not Applicable	4.5.3
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	Not Applicable	4.5.2
Groundwater quality degradation (plants with cooling ponds at inland sites)	Not Applicable	4.5.4
Radionuclides released to groundwater	Applicable	4.5.5
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts)	Applicable	4.6.5
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.6.4
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	Not Applicable	4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	Not Applicable	4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.6.3
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat	Applicable	4.6.6
Historic and Cultural Resources		
Historic and cultural resources	Applicable	4.7
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river) **Note**: 10 CFR 51, Subpart A, Appendix B, Table B-1 finding states, "These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals, or that discharge into rivers." Thus, including plants using lakes for cooling as plants where this Category 2 issue is applicable.	Applicable	4.9.1
Electric shock hazards	Applicable	4.9.2

Table 4.0-3 Category 2 Issues Applicability to PNPP (Sheet 2 of 2)

Resource Issue	Applicability	ER Section
Postulated Accidents		
Severe accidents	Applicable	4.15.2
Environmental Justice		
Minority and low-income populations	Applicable	4.10.1
Cumulative Impacts		
Cumulative Impacts	Applicable	4.12

4.1 Land Use and Visual Resources

Impacts to land use and visual resources are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to land use and visual resources. Therefore, Energy Harbor incorporates the NRC finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

4.2 Air Quality

Impacts to air quality are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to air quality. Therefore, Energy Harbor incorporates the NRC finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

4.3 Noise

Impacts to noise are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to noise. Therefore, Energy Harbor incorporates the NRC finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

4.4 Geology and Soils

Impacts to geology and soils are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to geology and soils. Therefore, Energy Harbor incorporates the findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

4.5 Water Resources

Impacts to water resources evaluated in the GEIS and considered to be generic (the same or similar at all plants), or Category 1 are listed in Section 4.0. Energy Harbor conducted a new and significant information review and identified no new and significant information related to water resources Category 1 issues. Therefore, Energy Harbor incorporates the findings of NRC Finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The Category 2 issues for water resources are discussed below.

4.5.1 Surface Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.5.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts could be of small or moderate significance, depending on makeup water requirements, water availability, and completing water demands.

4.5.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river…must be provided.

4.5.1.3 Background (GEIS Section 4.5.1.1]

Nuclear power plant cooling systems may compete with other users relying on surface water resources, including downstream municipal, agricultural, or industrial users. Closed-cycle cooling is not completely closed, because the system discharges blowdown water to a surface water body and withdraws water for makeup of both the consumptive water loss due to evaporation and drift (for cooling towers) and blowdown discharge. For plants using cooling towers, the makeup water needed to replenish the consumptive loss of water to evaporation can be significant and is reported at 60 percent or more of the condenser flow rate. Cooling ponds will also require makeup water as a result of naturally occurring evaporation, evaporation of the warm effluent, and possible seepage to groundwater.

Consumptive use by plants with cooling ponds or cooling towers using makeup water from a river during the license renewal term is not expected to change unless power uprates, with associated increases in water use, are proposed. Such uprates would require an environmental assessment by the NRC. In the 1996 GEIS, application of this issue applied only to rivers with low flow so as to define the difference between plants located on "small" versus "large" rivers. However, any river, regardless of size, can experience low flow conditions of varying severity during periods of drought and changing conditions in the affected watershed such as upstream diversions and use of river water. NRC has subsequently determined that use of the term "low flow" in categorizing river flow is of little value considering that all rivers can experience low flow conditions.

Population growth around nuclear power plants has caused increased demand on municipal water systems, including systems that rely on surface water. Municipal intakes located downstream from a nuclear power plant could experience water shortages, especially in times of drought. Similarly, water demands upstream from a plant could impact the water availability at the plant's intake.

Water use conflicts associated with plants with cooling ponds or cooling towers using makeup water from a river with low flow were considered to vary among sites because of differing site-specific factors, such as makeup water requirements, water availability (especially in terms of varying river flow rates), changing or anticipated changes in population distributions, or changes in agricultural or industrial demands.

4.5.1.4 Analysis

As presented in Section 2.2.3.1, PNPP uses a closed-cycle cooling system and a natural draft cooling tower. Service and makeup water for PNPP are obtained from Lake Erie. PNPP does not withdraw water from a river; therefore, this issue does not apply, and further analysis is not required.

4.5.2 Groundwater Use Conflicts (Plants with Closed-Cycle Cooling Systems that Withdraw Makeup Water from a River)

4.5.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Water use conflicts could result from water withdrawals from rivers during low-flow conditions, which may affect aquifer recharge. The significance of impacts would depend on makeup water requirements, water availability, and competing water demands.

4.5.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant uses cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands…must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

4.5.2.3 Background [GEIS Section 4.5.1.2]

In the case of plants with cooling towers or cooling ponds that rely on a river for makeup of consumed (evaporated) cooling water, it is possible water withdrawals from the river could lead to groundwater use conflicts with other users. This situation could occur because of the interaction between groundwater and surface water, especially in the setting of an alluvial aquifer in a river valley. Consumptive use of the river water, if significant enough to lower the river's water level, would also influence water levels in the alluvial aquifer. Shallow wells of nearby groundwater users could therefore have reduced water availability or go dry. During times of drought, the effect would occur naturally, although withdrawals for makeup water would increase the effect.

4.5.2.4 Analysis

As presented in Section 2.2.3 of this ER, PNPP uses a closed-cycle cooling system and a natural draft cooling tower. As stated in Section 4.5.1, PNPP does not withdraw water from a river; therefore, this issue does not apply, and further analysis is not required.

4.5.3 Groundwater Use Conflicts (Plants that Withdraw More Than 100 gpm)

4.5.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Plants that withdraw more than 100 gpm could cause groundwater use conflicts with nearby groundwater users.

4.5.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(C)

If the applicant's plant pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater must be provided.

4.5.3.3 Background [GEIS Section 4.5.1.2]

A nuclear plant may have several wells with combined pumping in excess of 100 gpm (378 liters per minute). Overall site pumping rates of this magnitude have the potential to create conflicts with other local groundwater users if the cone of depression extends to the offsite well(s). Large offsite pumping rates for municipal, industrial, or agricultural purposes may, in turn, lower the water level at power plant wells. For any user, allocation is normally determined through a state-issued permit.

Groundwater use conflicts have not been observed at any nuclear power plants, and no significant change in water well systems is expected over the license renewal term. If a conflict did occur, it might be possible to resolve it if the power plant relocated its well or wellfield to a different part of the property, The siting of new wells would be determined through a hydrogeologic assessment.

4.5.3.4 Analysis

As presented in Section 3.6.3.2, PNPP does not withdraw groundwater. A gravity-fed underdrain system is in use beneath Power Block structures to reduce hydrostatic pressure and to increase the dynamic stability of the structures. As presented in Section 3.6.2.2, the groundwater removal rate within the underdrain system is approximately 30 gpm. Therefore, this issue is NA and further analysis is not required.

4.5.4 Groundwater Quality Degradation (Plants with Cooling Ponds at Inland Sites)

4.5.4.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Inland sites with closed-cycle cooling ponds could degrade groundwater quality. The significance of the impact would depend on cooling pond water quality, site hydrogeologic conditions (including the interaction of surface and groundwater), and the location, depth, and pump rate of water wells.

4.5.4.2 Requirement [10 CFR 51.53(c)(3)(ii)(D)

If the applicant's plant is located at an inland site and uses cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided.

4.5.4.3 Background [GEIS Section 4.5.1.2]

Some nuclear power plants that rely on unlined cooling ponds are located at inland sites surrounded by farmland or forest or undeveloped open land. Degraded groundwater has the potential to flow radially from the ponds and reach offsite groundwater wells. The degree to which this occurs depends on the water quality of the cooling pond; site hydrogeologic conditions (including the interaction of surface water and groundwater); and the location, depth, and pump rate of water wells. Mitigation of significant problems stemming from this issue could include lining existing ponds, constructing new lined ponds, or installing subsurface flow barrier walls. Groundwater monitoring networks would be necessary to detect and evaluate groundwater quality degradation. The degradation of groundwater quality associated with cooling ponds has not been reported for any inland nuclear plant sites.

4.5.4.4 Analysis

As presented in Section 2.2.3 of this ER, PNPP uses a once-through cooling system and a natural draft cooling tower but does not use cooling ponds. Therefore, this issue is NA and further analysis is not required.

4.5.5 Radionuclides Released to Groundwater

4.5.5.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Leaks of radioactive liquids from plant components and pipes have occurred at numerous plants. Groundwater protection programs have been established at all operating nuclear power plants to minimize the potential impact from any inadvertent releases. The magnitude of impacts would depend on site-specific characteristics.

4.5.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(P)

An applicant shall assess the impact of any documented inadvertent releases of radionuclides into groundwater. The applicant shall include in its assessment a description of any groundwater protection program used for the surveillance of piping and components containing radioactive liquids for which a pathway to groundwater may exist. The assessment must also include a description of any past inadvertent releases and the projected impact to the environment (e.g., aquifers, rivers, lakes, ponds, ocean) during the license renewal term.

4.5.5.3 Background [GEIS Section 4.5.1.2]

The issue is relevant to license renewal because all commercial nuclear power plants routinely release radioactive gaseous and liquid materials into the environment. These radioactive releases are designed to be planned, monitored, documented, and released into the environment at designated discharge points. But over the years, there have been numerous events at nuclear power reactor sites that involved unknown, uncontrolled, and unmonitored releases of liquids containing radioactive material into the groundwater.

The majority of the inadvertent liquid release events involved tritium, which is a radioactive isotope of hydrogen. However, other radioactive isotopes, such as cesium and strontium, have also been inadvertently released into groundwater. The types of events include leakage from spent fuel pools, buried piping, and failed pressure relief valves on an effluent discharge line.

In 2006, the NRC's executive director for operations chartered a task force to conduct a lesson learned review of these incidents. On September 1, 2006, the task force issued its report: Liquid Radioactive Release Lessons Learned Task Force Report.

The most significant conclusion dealt with the potential health impacts on the public from the inadvertent releases. Although there were numerous events during which radioactive liquid was released to the groundwater in an unplanned, uncontrolled, and unmonitored fashion, based on the data available, the task force did not identify any instances where public health and safety were adversely impacted.

On the basis of information and experience with these leaks, the NRC concludes that the impact to groundwater quality from the release of radionuclides could be SMALL or MODERATE, depending on the magnitude of the leak, the radionuclides involved, hydrogeologic factors, the distance of receptors, and the response time of plant personnel in identifying and stopping the leak in a timely fashion.

4.5.5.4 Analysis

A description of the PNPP GPP is presented in Section 3.6.2.4. Table 3.6-3 presents well construction details for the PNPP groundwater monitoring wells, and Figure 3.6-7 shows the location of the wells. Table 3.6-7 presents information on 71 registered offsite water wells within a two-mile radius of the PNPP center point, and Figure 3.6-9 shows the locations of these wells.

As presented in Section 3.6.4.2.1, no unplanned liquid or gaseous radioactive releases occurred at PNPP in 2017 through 2019. Liquid tritium releases occurred in 2020 and 2021; however, tritium was not detected in any of the groundwater samples collected from the onsite piezometers or groundwater monitoring wells. The sources of the releases were addressed. There was no indication of any effluent releases via groundwater and no known spills or leaks to groundwater. Additional information about these two releases is provided in Section 3.6.4.2.

As previously mentioned in Section 3.6.3.2, an accidental release from the power block would be handled in the underdrain system by shutting off the pumps therein. Radiation monitors located in the gravity discharge manholes automatically stop the service and backup underdrain pumps upon detection of high radioactivity. Water in the underdrain system would be discharged via gravity drains to the ESW pumphouse and eventually to Lake Erie. The effluent from the ESW pumphouse is monitored in accordance and in compliance with NPDES permit requirements. However, if there is an accidental release of radioactive materials at the radwaste building, the estimated transit time to discharge into Lake Erie is 25 years if (a) the radioactive materials travel through soils, and (b) the groundwater elevation returns to elevation 620 feet.

Energy Harbor concludes that impacts from radionuclides to groundwater are SMALL and do not warrant additional mitigation measures beyond PNPP's existing GPP because water from plant uses continues to be processed and monitored in compliance with licensing and permitting.

4.6 Ecological Resources

The following sections address Category 2 issues. The Category 1 issues of this resource area are listed in Table 4.0-2. Energy Harbor conducted a new and significant information review and identified no new and significant information related to ecological resources Category 1 issues. Therefore, ENERGY HARBOR incorporates the findings of NRC Finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The Category 2 issues for ecological resources are discussed below.

4.6.1 Impingement and Entrainment of Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

4.6.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, OR LARGE. The impacts of impingement and entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling pond cooling systems, depending on cooling system withdrawal rates and volumes and the aquatic resources at the site.

4.6.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current CWA 316(b) determinations or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from impingement and entrainment.

4.6.1.3 Background [GEIS Section 4.6.1.2]

Impingement occurs when organisms are held against the intake screen or netting placed within intake canals. Most impingement involves fish and shellfish. At some nuclear power plants, other vertebrate species may also be impinged on the traveling screens or on intake netting placed within intake canals.

Entrainment occurs when organisms pass through the intake screens and travel through the condenser cooling system. Aquatic organisms typically entrained include ichthyoplankton (fish eggs and larvae), larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. Juveniles and adults of some species may also be entrained if they are small enough to pass through the intake screen openings, which are commonly 0.38 inches at the widest point.

The magnitude of the impact would depend on plant-specific characteristics of the cooling system (including location, intake velocities, screening techniques, and withdrawal rates) and characteristics of the aquatic resource (including population distribution, status, management objectives, and life history).

4.6.1.4 Analysis

As discussed in Section 2.2.3 of this ER, PNPP utilizes a closed cycle circulating water cooling system that draws water from and discharges to Lake Erie and is equipped with a cooling tower. Therefore, this issue is NA, and further analysis is not required.

4.6.2 Thermal Impacts on Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

4.6.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Most of the effects associated with thermal discharges are localized and not expected to affect overall stability of populations or resources. The magnitude of impacts, however, would depend on site-specific thermal plume characteristics and the nature of aquatic resources in the area.

4.6.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of a 316(a) variance in accordance with 40 CFR Part 125, or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from thermal changes.

4.6.2.3 Background [GEIS Section 4.6.1.2]

Because characteristics of both the thermal discharges and the affected aquatic resources are specific to each site, NRC classified heat shock as a Category 2 issues that required a site-specific assessment for license renewal. The NRC found the potential for thermal discharge impacts to be greatest at plants with once-through cooling systems, primarily because of the higher discharge temperatures and larger thermal plume area compared to plants with cooling towers.

The impact level at any plant depends on the characteristics of its cooling system (including location and type of discharge structure, discharge velocity and volume, and three-dimensional characteristics of the thermal plume) and characteristics of the affected aquatic resources (including the species present and their physiology, habitat, population distribution, status, management objectives, and life history).

4.6.2.4 Analysis

As discussed in Section 2.2.3 of this ER, PNPP utilizes a closed cycle circulating water cooling system that draws water from and discharges to Lake Erie and is equipped with a cooling tower. Therefore, this issue is NA, and further analysis is not required.

4.6.3 Water Use Conflicts with Aquatic Resources (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.6.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on aquatic resources in stream communities affected by water use conflicts could be of moderate significance in some situations.

4.6.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river, and related impacts on stream (aquatic)…ecological communities must be provided.

4.6.3.3 Background [GEIS 4.6.1.2]

Increased temperatures and/or decreased rainfall would result in lower river flows, increased cooling pond evaporation, and lowered water levels in the Great Lakes or reservoirs. Regardless of overall climate change, droughts could result in problems with water supplies and allocations. Because future agricultural, municipal, and industrial users would continue to share their demands for surface water with power plants, conflicts might arise if the availability of this resource decreased.

Water use conflicts with aquatic resources could occur when water to support these resources is diminished either because of decreased water availability due to droughts; increased demand for agricultural, municipal, or industrial usage; or a combination of such factors. Water use conflicts with biological resources in stream communities are a concern due to the duration of license renewal and potentially increasing demands on surface water.

4.6.3.4 Analysis

As discussed in Section 2.2.3 of this ER, PNPP withdraws makeup water from Lake Erie and not from a river. Therefore, this issue is NA, and further analysis is not required.

4.6.4 Water Use Conflicts with Terrestrial Resources (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.6.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on terrestrial resources in riparian communities affected by water use conflicts could be of moderate significance.

4.6.4.2 Requirement 10 [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action of water availability and competing water demands, the flow of the river, and related impacts on riparian (terrestrial) ecological communities must be provided.

4.6.4.3 Background [GEIS Section 4.6.1.1]

Water use conflicts with terrestrial resources in riparian communities could occur when water that supports these resources is diminished either because of decreased availability due to droughts; increased water demand for agricultural, municipal, or industrial usage; or a combination of such factors. For future license renewals, the potential range of impact levels at plants with cooling ponds or cooling towers using makeup water from a river cannot be determined at this time.

4.6.4.4 Analysis

As discussed in Section 2.2.3 of this ER, PNPP withdraws makeup water from Lake Erie and not from a river. Therefore, this issue is NA, and further analysis is not required.

4.6.5 Effects on Terrestrial Resources (Non-Cooling System Impacts)

4.6.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Impacts resulting from continued operations and refurbishment associated with license renewal may affect terrestrial communities. Applications of BMPs would reduce the potential for impacts. The magnitude of impacts would depend on the nature of the activity, the status of the resources that could be affected, and the effectiveness of mitigation.

4.6.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats.

4.6.5.3 Background [GEIS Section 4.6.1.1]

Continued operations and refurbishment activities could continue to affect onsite terrestrial resources during the license renewal term at all operating nuclear power plants. Factors that could potentially result in impacts include landscape maintenance activities, stormwater management, and elevated noise levels. These impacts would be similar to past and ongoing impacts.

The characteristics of terrestrial habitats and wildlife communities currently on nuclear power plant sites have generally developed in response to many years of typical operations and maintenance programs. While some may have reached a relatively stable condition, some habitats and populations of some species may have continued to change gradually over time. Operations and maintenance activities during the license renewal term are expected to be similar to current activities. Because the species and habitats present on the site (i.e., weedy species and habitats they make up) are generally tolerant of disturbance, it is expected that continued operations during the license renewal term would maintain these habitats and wildlife communities in their current state or maintain current trends of change.

Terrestrial habitats and wildlife could be affected by ground disturbance from refurbishment related construction activities. Land disturbed during the construction of new ISFSIs would range from about 2.5-10 acres. Other activities may include new parking areas for plant employees, access roads, buildings, and facilities. Temporary project support areas for equipment storage, worker parking, and material laydown areas could also result in the disturbance of habitat and wildlife.

Successful application of environmental review procedures, employed by the licensees at many of the operating nuclear plant sites, would result in the identification and avoidance of important terrestrial habitats. In addition, the application of BMPs to minimize the area affected, to control fugitive dust, runoff, and erosion from project sites; to reduce the spread of invasive nonnative plant species; and to reduce wildlife disturbance in adjacent habitats, could greatly reduce the impacts of continued operations and refurbishment activities.

4.6.5.4 Analysis

Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to important plant and animal habitats, and no further analysis is required.

Operational Activities

Terrestrial resources are described in Section 3.7.2. No license renewal-related construction activities or changes in operational practices have been identified that would involve disturbing habitats. While addition of shoreline protection measures is being evaluated for the eastern shoreline of the PNPP site, these measures have not been developed at the time of preparing this ER. Energy Harbor would continue to conduct ongoing plant operational and maintenance activities during the license renewal period. However, these activities are expected to have minimal impacts on terrestrial resources because activities are anticipated to occur within previously disturbed habitats.

Operational and maintenance activities that Energy Harbor might undertake during the renewal term, such as maintenance and repair of plant infrastructure (e.g., roadways, piping installations, fencing, and other security infrastructure), would likely be confined to previously disturbed areas of the site. Furthermore, as discussed in Section 9.6, Energy Harbor has administrative controls in place at PNPP to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs, permit modifications, or acquisition of new permits as needed. In addition, regulatory programs that the site is currently subject to such as stormwater management, spill prevention, dredging, and herbicide usage further serve to minimize impacts to terrestrial resources.

In summary, adequate management programs and regulatory controls are in place to ensure that important plant and animal habitats are protected during the license renewal period. Therefore, Energy Harbor concludes the impacts to the terrestrial ecosystems from license renewal are SMALL, and no additional mitigation measures beyond current management programs and existing regulatory controls are required.

4.6.6 Threatened, Endangered, and Protected Species, and Essential Fish Habitat

4.6.6.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

The magnitude of impacts on threatened, endangered, and protected species, critical habitat, and EFH would depend on the occurrence of listed species and habitats and the effects of power plant systems on them. Consultation with appropriate agencies would be needed to determine whether status species or habitats are present and whether they would be adversely affected by continued operations and refurbishment associated with license renewal.

4.6.6.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened and endangered species in accordance with federal laws protecting wildlife, including but not limited to, the ESA, and EFH in accordance with the Magnuson-Stevens Fishery Conservation and Management Act.

4.6.6.3 Background [GEIS Section 4.6.1.3]

There are several federal acts that provide protection to certain species and habitats that are treated here under a single issue. The issue includes impacts to biological resources such as threatened and endangered species and their critical habitat under the ESA, EFH as protected under the Magnuson-Stevens Fishery Conservation and Management Act and impacts to mammalian species protected under the Marine Mammal Protection Act.

Factors that could potentially result in impacts on listed terrestrial species include habitat disturbance, cooling tower drift, operation and maintenance of cooling systems, transmission line ROW maintenance, collisions with cooling towers and transmission lines, and exposure to radionuclides. The listed species on or in the vicinity of nuclear power plants also range widely, depending on numerous factors such as the plant location and habitat types present.

Potential impacts of continued operations and refurbishment activities on state or federally listed threatened and endangered species, protected marine mammals, and EFH could occur during the license renewal term. Factors that could potentially result in impacts to these species and habitats include impacts of refurbishment, other ground-disturbing activities, release of contaminants, effects of cooling water discharge on dissolved oxygen, gas supersaturation, eutrophication, thermal discharges, entrainment, impingement, reduction in water levels due to the cooling system operations, dredging, radionuclides, and transmission line ROW maintenance.

4.6.6.4 Analysis

Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to threatened, endangered, and protected species, designated critical habitat or EFH (which is not present in the Great Lakes), and no further analysis is required.

Operational Activities

Federally Listed Threatened and Endangered Species

As discussed in Section 3.7.8.1, a total of six species in Lake County, Ohio, are federally protected under the ESA: northern long-eared bat, Indiana bat, piping plover, red knot, Eastern Massasauga rattlesnake, and snuffbox mussel. In addition, the monarch butterfly is federally listed as a candidate species.

The current known range for the northern long-eared bat and Indiana bat overlaps with the PNPP site (USFWS 2022b). Suitable roosting and maternity habitat for both species is likely present at the PNPP site and the immediate vicinity; however, currently, there are no known occurrences of northern long-eared bats or Indiana bats within a 1-mile radius of the PNPP site. All plant operations are located in disturbed/developed areas of the site and large tree clearing is not anticipated; however, Energy Harbor (Regulatory Affairs) would consult with USFWS and/or OEPA to ensure compliance with the ESA. Compliance with all regulatory requirements associated with the federally listed species will continue to be an administrative control practiced by Energy Harbor for the life of the facility; thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on the northern long-eared bat and Indiana bat.

Piping plovers and red knots are shorebirds that use open habitats, such as beaches and mudflats. Both are small birds not known to be exceptionally prone to collision mortality, so the likelihood of collision with tall structures associated with PNPP is expected to be minimal. Collisions with in-scope transmission lines are not anticipated because in-scope transmission lines at the PNPP site are located in areas with no ecological value to these species. Energy Harbor maintains records of bird mortality and nesting within the PNPP; none of the dead birds recorded between 2017 and 2021 were identified to be piping plovers or red knots. Further, no records of either species have been documented within one mile of the PNPP site. Where warranted, Energy Harbor would consult with USFWS to ensure compliance with the ESA. Compliance with all regulatory requirements associated with these federally listed species will continue to be an administrative control practiced by Energy Harbor for the life of the facility; thus, the continued operation of the PNPP site for the proposed operating term MAY AFFECT BUT IS NOT LIKELY TO ADVERSELY AFFECT piping plovers or red knots.

The PNPP site is located within the designated critical habitat for the piping plover. The beach habitat on the PNPP site provides preferred habitat for nesting piping plovers. However, no changes or alternations to the operational activities of PNPP is proposed and no impacts to the beach is anticipated. While addition of shoreline protection measures is being evaluated for the eastern shoreline of the PNPP site, these measures have not been developed at the time of preparing this ER. If warranted, Energy Harbor would consult with USFWS to ensure compliance with the ESA. Compliance with all regulatory requirements associated with this federally listed species will continue to be an administrative control practiced by Energy Harbor for the life of the facility; thus, the continued operations of PNPP for the proposed operating term will have NO EFFECT on the designated critical habitat for the piping plover.

Eastern Massasauga rattlesnakes rely on a matrix of habitats to survive, and movement among habitats that contain roads increases the potential for vehicle collision mortality. Snakes in general are prone to collision mortality, because they use road surfaces for thermoregulation and their shape, coloration, and low profile make them difficult for automobile drivers to see. However, increased automobile traffic is not anticipated to occur as a result of continued operation of PNPP; therefore, the likelihood of mortality resulting from vehicle collisions is low. Further, there are no known occurrences of Eastern Massasauga rattlesnake within one mile of the PNPP site. The continued operation of the PNPP site for the proposed operating term will have NO EFFECT on the Eastern Massasauga rattlesnake.

Suitable habitat for the snuffbox mussel is likely present adjacent to the PNPP site in the waters of Lake Erie; however, according to USFWS IPaC data, the mussel is considered unlikely to occur within 6 miles of the PNPP site. (USFWS 2022d). Further, there has been no recent observation of the snuffbox in the vicinity of the PNPP site. Thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on the snuffbox mussel.

Suitable habitat for the monarch butterfly is likely present in undeveloped portions of the PNPP site that are not maintained by mowing as well as in the vicinity of the site. Existing regulatory programs that the site is subject to including management of herbicide applications ensure that habitats and wildlife are protected. Given that no changes or alterations to the operational activities of PNPP is proposed that would affect monarch habitat, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on the monarch butterfly.

State Listed Threatened and Endangered Species

As discussed in Section 3.7.8.2, a total of 30 animals and 33 plants that are threatened or endangered are listed by the ODNR as potentially occurring in Lake County (ODNR 2016a; ODNR 2020).

Many of the state listed species occur in habitats not found on the PNPP site including the least bittern, lilypad forktail, boreal bluet, marsh bluet, racket-tailed emerald, green-faced clubtail, American eel, black bear, a midge (*Rheopelopia acra*), black sandshell, threehorn wartyback and eastern pondmussel. However, these species may be present in the immediate vicinity. The least bittern may fly over the site during migration but is unlikely to use habitat within the PNPP site. Threehorn wartyback has been recorded within a one-mile radius of the PNPP site; however, they are typically found in large rivers and populations in Lake Erie appear to have been lost (COSEWIC 2013). The PNPP site also does not present suitable habitat for the state-listed plants including few-flowered St. John's-wort, alpine rush, yellow vetchling, flat-stemmed pondweed, early buttercup, keeled bur-reed, hobblebush, rock serviceberry, sweet-fern, log fern, least spike-rush, mountain bindweed, Canada St. John's-wort, cow wheat, northern poison ivy, and lyre-leaved rock cress. There are no known occurrences of these species within one mile of the PNPP site. Due to the lack of habitat onsite as well as adherence to administrative controls and existing programs such as stormwater management for controlling the runoff of pollution sources such as sediment, metals, or chemicals; spill prevention to ensure that BMPs and structural controls are in place to minimize the potential for a chemical release to the environment, operation of the site will not affect offsite habitat. Thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on these state-listed species.

Habitat for 19 state-listed animal species is either located on or near the PNPP site, or the species are highly mobile and may occur on the site and warrant further discussion. These include black bear, upland sandpiper, lark sparrow, northern harrier, black-crowned night-heron, *Chimarra socia*, *Psilotreta indecisa*, northern bluet, Uhler's sundragon, riffle snaketail, lake sturgeon, cisco, Iowa darter, northern brook lamprey, shortnose gar, pugnose minnow, fawnsfoot, and spotted turtle.

Habitat for black bears is likely present at the PNPP site; however, black bears tend to be transient in nature and would use the site minimally. Since no changes or alternations to the operational activities of PNPP is proposed and no habitat alternations are proposed, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on black bears.

Migratory movements or local flight patterns might result in the occurrence of upland sandpiper, lark sparrow, northern harrier, and black-crowned night-heron on the PNPP site. Habitat for these species may be located on portions of the PNPP site not utilized for operations. However, activities on the PNPP site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Compliance with all regulatory requirements associated with these species will continue to be an administrative control practiced by Energy Harbor for the life of the PNPP facility. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to these species. Thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on these state-listed species.

Chimarra socia, *Psilotreta indecisa*, northern bluet, Uhler's sundragon, and riffle snaketail occur in aquatic habitats such as wetlands, ponds, and lakes. Continued operations of PNPP do not involve clearing activities or modifications to existing aquatic habitat. Further, adherence to stormwater management and spill prevention protocols and procedures will ensure that operations will not affect aquatic habitat at the PNPP site. As such, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT to these state-listed invertebrate species.

Given the restricted range and habitat requirements for lake sturgeon, cisco, Iowa darter, northern brook lamprey, shortnose gar, and pugnose minnow, these species are unlikely to occur in the nearshore areas of Lake Erie where the PNPP site is located. ODNR fish sampling results for Lake Erie conducted between 1987 and 2020 did not identify any of these species (ODNR 2021a). Further, adherence to stormwater management and spill prevention protocols and procedures will ensure that operations will not affect the waters of Lake Erie within and in the vicinity of the PNPP site. Thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on state-listed animal species.

The PNPP site provides potential habitat for the following state-listed plant species: short-fringed sedge, rock-harlequin, Canada hawkweed, inland beach pea, dwarf bulrush, bushy cinquefoil, leafy goldenrod, American beach grass, Cooper's milk-vetch, leafy tussock sedge, nodding sedge, thread-like naiad, large-leaved mountain-rice, white wood-sorrel, coastal little bluestem, and bristly sarsaparilla. The range of habitats the state-listed plants represent indicates that some of the species could occur within the PNPP site, but the extent of their occurrence is undetermined except for two species: the American beach grass has been observed at the PNPP site along the shoreline of Lake Erie, and the island beach pea has been recorded to occur within a one-mile radius of the PNPP site. Because continued operations of PNPP do not involve clearing activities, state-listed plant species on the site are not likely to be impacted by the continued operations of PNPP. Thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT to state-listed plant species.

<u>Bald Eagles</u>

Bald eagles have been observed at the PNPP site as recently as 2021, but no surveys have been conducted. There are currently no MBTA or BGEPA permits associated with onsite PNPP operations. When necessary, consultation with responsible agencies (i.e., USFWS and ODNR) is conducted to maintain compliance with existing regulations. Compliance with all regulatory requirements associated with bald eagles will continue to be an administrative control practiced by Energy Harbor for the life of the PNPP facility. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to bald eagles. Thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on bald eagles.

Migratory Birds

As stated in Section 3.7.8.3, suitable habitat is potentially present on the PNPP site and immediate vicinity for 16 birds of conservation concern protected under the MBTA (USFWS 2022b). Lesser yellowlegs, Ruddy turnstone, short-billed dowitcher occur as migrants through Lake County and may utilize stop-over habitat available at the PNPP site or in the vicinity. These three species are known to breed elsewhere. Bald eagle, black-billed cuckoo, blue-winged warbler, bobolink, Canada warbler, Cerulean warbler, evening grosbeak, golden eagle, golden-winged warbler, long-eared owl, prairie warbler, red-headed woodpecker, and wood thrush are known to breed in Lake County (USFWS 2022b) and have the potential to occur at the PNPP site. There are currently no MBTA or BGEPA permits associated with onsite PNPP operations or in-scope transmission lines. However, Energy Harbor maintains policies and procedures for addressing avian incident associated with the PNPP site. Based on PNPP records, there were seven condition reports relating to bird mortality between 2017-2021. Species were not definitively identified for two recorded; however, one was documented as an eastern yellow billed cuckoo and a pigeon. In 2021, 60 skeletonized birds were discovered on the circulating water basin screens. Additionally, an injured peregrine falcon that was discovered at the PNPP site was brought to a rehab center located at the Lake Metroparks – Kirtland Penitentiary Glen Reservation. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Compliance with all regulatory requirements associated with migratory birds will continue to be an administrative control practiced by Energy Harbor for the life of the PNPP facility. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to migratory birds. Thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on migratory birds.

Essential Fish Habitat

As stated in Section 3.7.8.5, no EFH is located within the vicinity of PNPP, nor were any EFH areas protected from fishing. As HAPCs are derived from EFH, there were also no HAPCs located within the six-mile vicinity of PNPP (NOAA 2022d). Thus, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on EFH.

4.7 Historic and Cultural Resources

4.7.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Continued operations associated with license renewal are expected to have no license renewal-related impacts as no refurbishment or construction activities have been identified; administrative procedure ensures protection of historic properties in the event of excavation activities. The NHPA requires the federal agency to consult with the SHPO and appropriate Native American tribes to determine the potential effects on historic properties and mitigation, if necessary.

4.7.2 Requirement [10 CFR 51.53(c)(3)(ii)(K)]

All applicants shall identify any potentially affected historic or archaeological properties and assess whether any of these properties will be affected by future plant operations and any planned refurbishment activities in accordance with the NHPA.

4.7.3 Background [GEIS Section 4.7.1]

The NRC will identify historic and cultural resources within a defined APE. The license renewal APE is the area that may be impacted by ground-disturbing or other operational activities associated with continued plant operations and maintenance during the license renewal term and/or refurbishment. The APE typically encompasses the nuclear power plant site, its immediate environs, including viewshed, and the transmission lines within this scope of review. The APE may extend beyond the nuclear plant site and transmission lines when these activities may affect historic and cultural resources.

Continued operations during the license renewal term and refurbishment activities at a nuclear power plant can affect historic and cultural resources through (1) ground-disturbing activities associated with plant operations and ongoing maintenance (e.g., construction of new parking lots or building), landscaping, agricultural, or other use of plant property; (2) activities associated with transmission line maintenance (e.g., maintenance of access roads or removal of dangerous trees); and (3) changes to the appearance of nuclear power plants and transmission lines. Licensee renewal environmental reviews have shown that the appearance of nuclear power plants and transmission lines has not changed significantly over time; therefore, additional viewshed impacts to historic and cultural resources are not anticipated.

4.7.4 Analysis

4.7.4.1 Refurbishment Activities

As presented in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to historic and cultural resources, and no further analysis is required.

4.7.4.2 Operational Activities

As presented in Section 3.8.5, there has been one previous cultural resources survey within the approximately 1,030-acre PNPP property. There have been an additional 15 cultural resources surveys documented within a 6-mile radius of the PNPP property. There are no archaeological entries and no NRHP eligible cultural resources confirmed within the approximately 1,030-acre PNPP property (Table 3.8-1). There are no structures within the PNPP property listed on the OHI (Table 3.8-2).

As presented in Section 3.8.6, although no license renewal-related ground-disturbing activities have been identified, Energy Harbor has guidance in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These consist of the excavation and trenching controls and the environmental evaluations procedures. These procedures define AC&H resources and are designed to protect against the impacts to properties, sites, and unanticipated discoveries of AC&H resources. Therefore, no adverse effects are anticipated to any sites during the PNPP proposed LR operating term.

The area within a 6-mile radius of the site, is archaeologically sensitive (Table 3.8-1). There is one NRHP eligible and one NRHP listed archaeological site within 6 miles of PNPP. The NRHP eligible site LA0158, and NRHP listed site LA0002/74001543, are over 4.90 miles from PNPP. Adverse impacts, however, would only occur to the sites as a result of soil-intrusive activities. Because Energy Harbor has no plans to conduct such soil-intrusive activities at any location outside of the property boundary under a renewed license, no adverse effects to these archaeological sites would occur.

There is one NRHP eligible above ground historic structure within a six-mile radius of PNPP, DOE 2352 (Table 3.8-1). DOE 2352, a cobble stone outbuilding, is located approximately 1.16 miles from PNPP. As noted in Section 3.8.4, the Unit 2 cooling tower and the steam plume from the Unit 1 cooling tower are visible from the cobblestone outbuilding. As there are no modifications to PNPP planned during the LRA period, there will be no change in the noise and visual impacts to this resource and no adverse effects to the physical or historical integrity of this site is anticipated.

There are 35 NRHP listed properties and one NRHP district within 6 miles of PNPP (Table 3.8-4). The closest property, 76001462 the Lucius and Corrilla Green House, is over 2.9 miles from PNPP. Due to distance, topography and vegetation, the visual and noise impacts to the 76001462 property will be minimal. The remaining 34 NRHP properties and the NRHP district are all over 3.7 miles from the PNPP site. Therefore, any visual or noise related impacts to these NRHP properties would be minimal due to distance, topography, and vegetation.

As presented above, no license renewal-related refurbishment or construction activities have been identified. No offsite NRHP-listed historic properties will be adversely impacted as a result of continued operations of PNPP, and there are no plans to alter operations, expand existing facilities, or disturb additional land for the proposed license renewal term. In addition, administrative procedural controls are in place for protection of cultural resources ahead of any future ground-disturbing activities at the plant. Therefore, Energy Harbor concludes that there will be no adverse effects as a result of continued operation of PNPP during the proposed license renewal term, and additional mitigation measures beyond Energy Harbor's existing procedural administrative controls are not warranted.

4.8 Socioeconomics

Impacts to socioeconomics are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to socioeconomics. Therefore, Energy Harbor incorporates the NRC finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

4.9 Human Health

Impacts to human health evaluated in the GEIS that are considered to be generic (the same or similar at all plants), or Category 1 issues are listed in Section 4.0.1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to human health Category 1 issues. Therefore, the analyses and findings regarding these human health Category 1 issues in the GEIS (NUREG-1437, Revision 1) and 10 CFR Part 51, Subpart A, Appendix B, Table B-1 are incorporated herein by reference, and no further analysis is required. The Category 2 issues for human health are discussed below.

4.9.1 Microbiological Hazards to the Public (Plants with Cooling Ponds or Canals, or Cooling Towers that Discharge to a River)

4.9.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals, or that discharge into rivers. Impacts would depend on site-specific characteristics.

4.9.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(G)]

If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river, an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.

4.9.1.3 Background [GEIS Section 4.9.1.1.3]

N. fowleri, which is the pathogenic strain of the free-living amoebae *Naegleria* spp., appears to be the most likely microorganism that may pose a public health hazard resulting from nuclear power plant operations. Increased populations of *N. fowleri* may have significant adverse impacts.

Since *Naegleria* concentrations in freshwater can be enhanced by thermal effluents, nuclear power plants that use cooling lakes, canals, ponds, or rivers experiencing low-flow conditions may enhance the populations of naturally occurring thermophilic organisms.

Changes in microbial populations and in the public use of water bodies might occur after the operating license is issued and the application for license renewal is filed. Other factors could also change, including the average temperature of the water, which could result from climate change that affected water levels and air temperature. Finally, the long-term presence of a power plant might change the natural dynamics of harmful microorganisms within a body of water.

4.9.1.4 Analysis

Section 3.10.1 describes the thermophilic microorganisms that the 2013 GEIS identified to be of potential concern at nuclear power plants. Also, Section 3.10.1 mentions that there have been no reported cases of primary amebic meningoencephalitis in Ohio and no waterborne disease cases for untreated recreational waters in Ohio attributed to any of the microorganisms of particular concern in the most recent Centers for Disease Control and Prevention report (CDC 2019; CDC 2021a).

PNPP releases blowdown from the cooling tower basin comingled with other plant water use discharges to the discharge tunnel which is then discharged to Lake Erie. During 2018-2022, the maximum daily temperature in the discharge during the summer months was generally in the 70s- and 80s-degrees Fahrenheit with the highest being 91°F. The temperature of the Lake Erie waters at the discharge point and the surrounding waters would be well below the optimum growth temperature for intestinal pathogens such as *Shigella*, *Cryptosporidium*, and *Giardia* (optimum growth at 98.6 °F) (CDC 2021b, CDC 2021c, Todar 2020), the free-living ameba *N. fowleri* (optimum growth at 115 °F) (NRC 2013b), and the free-living bacteria, *Pseudomonas aeruginosa* (optimum growth at 98.6 °F) (Todar 2020).

Public exposure to aerosolized *Legionella* from nuclear plant operations is not a concern because such exposure would be confined to a small area of the site near the cooling tower. The cooling tower, basin, and exit to the submerged discharge tunnel are within the plant's fenced and security-patrolled protected area.

Based on the optimum growth temperatures for the thermophilic microorganisms of concern, PNPP's thermal discharge is unlikely to enhance such microorganisms, if present. Additionally, the mixing of the discharge with the ambient Lake Erie waters would further lower temperatures below optimum growth temperatures. The public would not be exposed to aerosolized *Legionella* from PNPP's cooling water system because public access is restricted by the security control of the protected area. Therefore, the microbiological hazard to the public from PNPP's thermal discharge during the LR term would be SMALL.

Regulatory Guide 4.2 for license renewal applicants directs the applicant to consult with the state public health department—in this case, the Ohio Department of Health, regarding concerns about the potential for waterborne disease outbreaks associated with license renewal (NRC 2013b). Correspondence is included in Attachment E.

4.9.2 Electric Shock Hazards

4.9.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Electrical shock potential is of small significance for transmission lines that are operated in adherence with the National Electrical Safety Code (NESC). Without a review of conformance with NESC criteria of each nuclear power plant's in-scope transmission lines, it is not possible to determine the significance of the electrical shock potential.

4.9.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(H)]

If the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.

4.9.2.3 Background [GEIS Section 4.9.1.1.5]

Design criteria for nuclear power plants that limit hazards from steady-state currents are based on the NESC, adherence to which requires that utility companies design transmission lines so that the short-circuit current to ground produced from the largest anticipated vehicle or object is limited to less than five milliamperes. With respect to shock safety issues and license renewal, three points must be made. First, in the licensing process for the earlier licensed nuclear plants, the issue of electrical shock safety was not addressed. Second, some plants that received operating licenses with a stated transmission line voltage may have chosen to upgrade the line voltage for reasons of efficiency, possibly without reanalysis of induction effects. Third, since the initial NEPA review for those utilities that evaluated potential shock situations under the provision of the NESC, land use may have changed, resulting in the need for a reevaluation of this issue. The electrical shock issue, which is generic to all types of electrical generating stations, including nuclear plants, is of SMALL significance for transmission lines that are operated in adherence with the NESC. Without a review of the conformance of each nuclear plant's transmission lines, within this scope of review with NESC criteria, it is not possible to determine the significance of the electrical shock potential generically.

4.9.2.4 Analysis

As discussed in Section 3.10.2, the in-scope transmission lines are within the OCA of PNPP which minimizes the risk of electric shock hazards to the public.

As discussed in Section 3.10.2, the in-scope transmission lines are in compliance with applicable clearance requirements within the 2017 NESC.

As discussed in Section 3.10.2, work on and near the transmission lines is governed by plant procedures and PNPP's comprehensive health and safety program. Given these conditions, the human health impact from electric shock hazards during the proposed LR operating term would be SMALL.

4.10 Environmental Justice

The NRC identified only one issue for environmental justice. This is a Category 2 issue and is discussed below, providing background and the analysis identified as pertaining to the proposed LR operating term.

4.10.1 Minority and Low-Income Populations

4.10.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Impacts to minority and low-income populations and subsistence consumption resulting from continued operations and refurbishment associated with license renewal will be addressed in plant-specific reviews. See NRC Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040).

4.10.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(N)]

Applicants shall provide information on the general demographic composition of minority and low-income populations and communities (by race and ethnicity) residing in the immediate vicinity of the plant that could be affected by the renewal of the plant's operating license, including any planned refurbishment activities, and ongoing and future plant operations.

4.10.1.3 Background [GEIS Section 4.10.1]

Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. Minority and low-income populations are subsets of the general public residing around the site and all are exposed to the same risks and hazards generated from operating a nuclear power plant.

Continued reactor operations and other activities associated with license renewal could have an impact on air, land, water, and ecological resources in the region around each nuclear power plant site, which might create human health and environmental effects on the general population. Depending on the proximity of minority and low-income populations in relation to each nuclear plant, the environmental impacts of license renewal could have a disproportionate effect on these populations.

The location and significance of environmental impacts may affect population groups that are particularly sensitive because of their resource dependencies or practices (e.g., subsistence agriculture, hunting, or fishing) that reflect the traditional or cultural practices of minority and low-income populations. The analysis of special pathway receptors can be an important part of the identification of resource dependencies or practices. Special pathways take into account the levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the power plant sites in order to assess the risk of radiological exposure through subsistence consumption of fish, native vegetation, surface water, sediment, and local produce; the absorption of contaminants in sediments through the skin; and the inhalation of airborne particulates.

4.10.1.4 Analysis

4.10.1.4.1 Refurbishment Activities

As presented in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license-renewal-related refurbishment impacts to minority and low-income populations, and no further analysis is applicable.

4.10.1.4.2 Operational Activities

The consideration of environmental justice is required to assure that federal programs and activities will not have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Energy Harbor's analyses of the Category 2 issues defined in 10 CFR 51.53(c)(3)(ii) determined that environmental impacts from the continued operation of PNPP during the LR operating term would either be SMALL or non-adverse. Therefore, high, or adverse impacts to the general human population would not occur.

As described in Section 3.10, PNPP maintains a REMP. With this program, Energy Harbor monitors important radiological pathways and considers potential radiation exposure to plant and animal life in the environment surrounding PNPP. The results of the program indicate PNPP has created no adverse environmental effects or health hazards. Therefore, no environmental pathways have been adversely impacted and are not anticipated to be impacted during the PNPP LR term.

Section 3.11.2 identifies the locations of minority and low-income populations as defined by Nuclear Reactor Regulation (NRR) Office Instruction LIC-203 (NRC 2020b). Section 3.11.3 describes the search for subsistence populations near PNPP, of which none were found. The figures accompanying Section 3.11.2 show the locations of minority and low-income populations within a 50-mile radius of PNPP. None of those locations, when considered in the context of impact pathways described in this chapter, are expected to be disproportionately impacted.

Therefore, NO DISPROPORTIONATELY HIGH AND ADVERSE impacts or effects on members of the public, including minority, low-income, or subsistence populations, are anticipated as a result of LR.

4.11 Waste Management

Impacts to waste management are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to waste management. Therefore, Energy Harbor incorporates the findings of NRC Finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

4.12 Cumulative Impacts

Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Cumulative impacts of continued operations and refurbishment associated with license renewal must be considered on a plant-specific basis. Impacts would depend on regional resource characteristics, the resource-specific impacts of license renewal, and the cumulative significance of other factors affecting the resource.

Requirement [10 CFR 51.53(c)(3)(ii)(O)]

Applicants shall provide information about other past, present, and reasonably foreseeable future actions occurring in the vicinity of the nuclear plant that may result in a cumulative effect.

Background [GEIS Section 4.13]

Actions to be considered in cumulative impact analyses include new and continuing activities, such as license renewal, that are conducted, regulated, or approved by a federal agency. The cumulative impacts analysis takes into account all actions, however minor since impacts from individually minor actions may be significant when considered collectively over time. The goal of the analysis is to identify potentially significant impacts to improve decisions and move toward more sustainable development.

For some resource areas (e.g., water and aquatic resources), the contributions of ongoing actions within a region to cumulative impacts are regulated and monitored through a permitting process (e.g., NPDES) under state or federal authority. In these cases, it may be assumed that cumulative impacts are managed as long as these actions (facilities) are in compliance with their respective permits.

Analysis

Cumulative impacts analysis involves determining if there is an overlapping or compounding of the anticipated impacts of the continued operation of PNPP during the proposed LR operating term with past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such actions.

Energy Harbor considered potential cumulative impacts during the license renewal period in its environmental analysis associated with the resources discussed in the following sections. For the purposes of this analysis, past actions are those related to the resources at the time of plant licensing and construction, present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of the plant operation, which would include the 20-year license renewal term. These criteria are in line with Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b). The geographic area over which past, present, and future actions would occur is dependent on the type of action considered and is described below for each impact area. The effects of past actions are already reflected in the description of the affected environment in Chapter 3.

The impacts of the proposed action are combined with other past, present, and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such other actions. These combined impacts are defined as "cumulative" in 40 CFR Part 1508.7 and include individually minor, but collectively significant, actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

As indicated in Section 3.1.4, no major changes to PNPP Unit 1 operations or plans for future expansion of plant infrastructure during the proposed LR term are anticipated. There is one potential future PNPP shoreline protection project. It is proposed to add shoreline protection to arrest continued erosion along the currently unprotected site northeast shoreline. It would be approximately 1,200 feet in length, starting where the existing installed shoreline protection features stop north of the cooling tower, extending east approximately 1,200 feet, approaching the eastern lakeshore property line. Evaluation of options are ongoing, and a final design has not been selected (sheet piling, armor stone revetment, etc.). Currently the plan is funded for 2023 (mainly design/permitting) and tentatively scheduled to be installed in 2024.

Section 3.1.4 describes other (non-PNPP related) projects in the vicinity of PNPP. In 2021, the village of North Perry began the process of mitigating the effects of severe erosion on the Lake Erie shoreline. North Perry and 12 other Lake County communities approved legislation to be part of a Shoreline Special Improvement District to help residents who own property along Lake Erie to secure special financing to complete erosion-control projects. Also in 2021, Perry TWP began an erosion control project on the Lake Erie shoreline to fortify a severely eroded bluff in the township park behind the Parmly Mansion. Ohio's STIP for 2021-2024 lists several proposed highway projects for Lake County. One identified 2022 STIP project located within Perry TWP south of PNPP is described as a major rehabilitation of US 20/N. Ridge Rd involving minor widening and drainage replacement. A number of side streets located in the US 20/N. Ridge Rd project area, including Center Rd, will continue to remain open during the construction period. Currently construction will take place in three segments and is scheduled to begin Spring 2023 and end Fall 2025.

4.12.1 Land Use and Visual Resources

PNPP operations have a SMALL impact on the land use (NRC 2013a). Based on the information provided in Section 3.1.4, there are currently no planned projects for the PNPP site that would be expected to require a change in land use. Similarly, as discussed in Section 3.1.4 there were no projects identified near PNPP that would be expected to require land use changes. Therefore, the cumulative land use impact would be SMALL.

The PNPP vicinity is described in Section 3.2, PNPP is located on the southeastern shoreline of Lake Erie and within North Perry in Lake County, Ohio. The surrounding area is a mixture of rural residential, towns and small communities, agricultural land, deciduous forest, and lakeshore frontage.

As stated in Section 3.2.3, the continued use of existing structures associated with PNPP would not alter their visual impact. Because of the nature of the projects (non-PNPP related) listed in Section 3.1.4, they would not be expected to combine with the visual impacts of PNPP. Because the visual impacts due to PNPP are SMALL, not expected to change, and are not expected to contribute to PNPP's visual impacts, the cumulative visual impacts are expected to be SMALL.

4.12.2 Air Quality

4.12.2.1 Air Quality

Section 3.3.3 discusses regional air quality and PNPP's emission sources. PNPP is in an AQCR that has seven counties not in attainment for 8-hour ozone (2015). The remaining counties are in attainment for air quality. However, as illustrated in Figure 3.3-6 through 3.3-9, many of the counties are maintenance areas for criteria pollutants.

PNPP's air pollutant emissions are minimal and stem from intermittent use, maintenance and testing of stationary generators and miscellaneous diesel equipment. The planned projects listed above could result in localized temporary air emissions from construction equipment. Implementing fugitive dust BMPs and maintaining portable equipment in proper working order will minimize air emissions. Compliance with the existing air permit and any future permit would minimize impacts to air quality.

The pending present actions and anticipated future actions along with continued operation of PNPP is expected to have a SMALL impact on cumulative air quality.

4.12.2.2 Climate Change

Climate change can impact air quality as a result of changes in meteorological conditions. Air pollutant concentrations are sensitive to winds, temperature, humidity, and precipitation. Ozone levels have been found to be particularly sensitive to climate change influences. Sunshine, high temperatures, and air stagnation are favorable meteorological conditions which lead to higher levels of ozone. Although surface temperatures are expected to increase, ozone levels will not necessarily increase because ozone formation is also dependent on the relative amounts of precursors available. The combination of higher temperatures, stagnant air masses, sunlight, and emissions of precursors may make it difficult to meet ozone NAAQS. States, however, must continue to comply with the CAA and ensure air quality standards are met. (NRC 2015) Because fuel source for Unit 1 does not produce carbon dioxide (CO_2) or other GHG emissions, the continued operation of PNPP would avoid millions of tons of GHGs from a fossil fuel-fired alternative such as the natural gas combined cycle (NGCC) presented in Chapter 7.

Given that climate change trends in air temperature and precipitation are increasing, but continued operation would contribute only small emissions of GHGs from minor air emission sources, the cumulative impact on climate change from present and future actions would be SMALL. Moreover, continued operation at PNPP avoids millions of tons of CO_2 from alternative fossil-fuel generation, positively impacting the climate change factor of CO_2 concentrations.

4.12.2.3 Noise

As presented in the GEIS Section 4.3.1.2, the NRC determined that the continued operation of a nuclear plant in a license renewal term to have a small impact due to noise. As such, PNPP operations have a SMALL impact on the noise environment (NRC 2013a). The projects listed in Section 3.1.4 are construction projects that would be expected to be SMALL and limited in duration. Because the noise impacts from continued plant operations over the license renewal term would be SMALL and the expected noise impacts from the projects listed in Section 3.1.4 would be SMALL and limited in duration, cumulative noise impacts would be SMALL.

4.12.3 Geology and Soils

Impacts to geology and soils could result from ground-disturbing activities and stormwater runoff. As stated in Section 2.3, PNPP has no plans to conduct LR-related refurbishment or replacement activities. Section 3.1.4 discusses future projects that may include mitigating shoreline erosion which would be expected to reduce the impacts on soils.

The NRC concluded that a site's impact on geology and soils would be SMALL (NRC 2013a). Any ground-disturbing activities onsite during the proposed LR operating term would be governed by a stormwater construction permit and/or the SWPPP. Given ground disturbances at the PNPP site would be limited to the current site area, subject to construction and stormwater permitting and applicable BMPs, therefore the cumulative land use impact would be SMALL.

4.12.4 Water Resources

4.12.4.1 Surface Water

As presented in Section 2.2.3.1, PNPP uses a closed-cycle cooling system with a natural draft cooling tower. Service and makeup water for PNPP are obtained from Lake Erie. As described in GEIS Section 4.5, the impact on surface water resources for closed-cycle cooling systems that do not withdraw water from a river is SMALL [10 CFR Part 51, Subpart A, Appendix B, Table B-1]. Energy Harbor did not identify any new and significant information for this environmental issue.

As for surface water quality cumulative impacts, and as discussed in Chapter 9, PNPP complies with its NPDES discharge limits, and the discharge rapidly mixes with Lake Erie. As discussed in Section 3.6.4.1, the water quality at several tributaries to Lake Erie near PNPP are impaired; however, PNPP operations do not contribute to these impairments. Therefore, the cumulative impact to surface water quality would be SMALL. Given PNPP compliance with its NPDES permit and compliance with stormwater permits and regulations, PNPP would have only a SMALL contribution to the surface water quality cumulative impact.

4.12.4.2 Groundwater

As discussed in Section 4.5.3 and described in Section 2.2, all water used at PNPP comes from Lake Erie, there are no groundwater production wells. Therefore, Energy Harbor concludes that PNPP does not contribute to cumulative groundwater use impacts.

4.12.4.3 Climate Change

In the Great Lakes region, precipitation has been increasing over the past several decades. The lake temperature of Lake Erie has shown an increase of 0.01 to 0.18 degrees Fahrenheit per year (USCRT 2020). As discussed in Section 3.6.1.2.6, the service water system was designed for two operating reactors where PNPP has only one operational reactor. As such, there is currently excess capacity, and the service water temperature will not exceed its original design discharge temperature.

As previously mentioned, PNPP operations do not require significant surface water consumption or need groundwater withdrawals. There are no anticipated or reasonably foreseeable changes in surface water withdrawal rates or groundwater withdrawals. In addition, the current trends in water temperature due to climate change in Lake Erie are small and the local nature of the temperature effects of PNPP operations does not exceed its original design temperatures.

Based on these findings, the potential cumulative impacts of thermal discharges originating from present and future actions combined with climate change would be SMALL.

4.12.5 Ecological Resources

4.12.5.1 Terrestrial

The impacts on terrestrial species during the proposed LR operating term are described as SMALL in Section 4.6.5.4. The continued operation of PNPP Unit 1 is governed by regulations, PNPP procedures, and plans. As discussed in Section 9.6, PNPP has administrative controls in place at PNPP to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMP's, permit modifications, or acquisition of new permits as needed.

Successful application of the regulation, procedures, plans, and administrative controls would result in the identification and avoidance of important terrestrial habitats. In addition, the application of BMPs minimizes the affected area. Fugitive dust, runoff, and erosion from project sites are controlled; the spread of invasive nonnative plant species is reduced; disturbance of adjacent wildlife habitats is reduced. These factors could greatly reduce the impacts of continued operations (NRC 2013b).

Regulatory programs that the site is currently subject to, such as stormwater management, spill prevention, dredging, and herbicide usage, further minimize impacts on terrestrial resources. However, as described in Section 3.6.1.2.4, no periodic maintenance dredging has occurred at PNPP and no dredging activities in the vicinity of the intake and discharge are anticipated. With continued application of these programs and procedures, the land-based impacts would largely be confined to PNPP property and would have minimal opportunity to contribute to cumulative impacts.

As discussed in Sections 3.7.8 and 4.6.6.4, habitat for federally and state-listed terrestrial species exists on the PNPP site. However as stated in Section 4.6.6.4, impacts to federally listed and state listed threatened and endangered species range from NO EFFECT to MAY AFFECT BUT IS NOT LIKELY TO ADVERSELY AFFECT. Energy Harbor's compliance with all regulatory requirements associated with the federally listed and state listed species will continue to be an administrative control practiced for the life of the facility.

As discussed in Section 4.6.5.4, maintenance activities necessary to support license renewal likely would be limited to previously disturbed areas onsite during the proposed LR term rather than within any other habitat on the site. The nature of the projects discussed in Section 3.1.4 are limited to or very near previously disturbed areas and are expected to have a SMALL impact on habitat. Therefore, cumulative impacts on protected species would be SMALL.

Overall, the cumulative impacts to terrestrial ecological resources are anticipated to be SMALL.

4.12.5.2 Aquatic

As discussed in Section 2.2.3.1, PNPP uses a closed-cycle cooling system with a cooling tower that withdraws water from Lake Erie. 10 CFR Part 51, Subpart A, Appendix B Table B-1 concluded that aquatic resource impacts due to impingement and entrainment of aquatic organisms and thermal impacts on aquatic organisms were SMALL for closed-cycle cooling systems. As discussed in Section 4.6.1 and 4.6.2, the GEIS concluded that closed cycle cooling that did not withdraw water from a river did not lead to water use conflicts. Therefore, this issue is NA to PNPP.

As discussed in Sections 4.6.6.4, the continued operation of the PNPP site for the proposed operating term will have NO EFFECT on habitat for federally and state-listed aquatic species. As stated in Section 3.7.8.4, no EFH is located within the vicinity of PNPP, nor were any EFH areas protected from fishing. As HAPCs are derived from EFH, there were also no HAPCs located within the 6-mile vicinity of PNPP.

Therefore, PNPP contribution to cumulative aquatic ecological impacts communities would be SMALL.

4.12.5.3 Climate Change

Temperatures in the Great Lakes region have been increasing over the past several decades. Annual precipitation has also increased. The water temperatures measured for Lake Erie have shown an increase of 0.01 to 0.18 degrees Fahrenheit per year in the PNPP area. With a changing climate, there will be changes in the range and distribution of species (USCRT 2020).

The current trends in water temperature due to climate change in Lake Erie are small and the local nature of the temperature effects of PNPP operations does not exceed its original design temperatures. Therefore, the continued operation of PNPP would be a small contributor to climate change effects that impact vulnerable aquatic species due to rising temperature. Therefore, cumulative thermal impacts to ecological communities from PNPP and climate change are anticipated to be SMALL during the proposed LR operating term.

As discussed in Section 9.6, Energy Harbor has administrative controls in place at PNPP to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs, permit modifications, or acquisition of new permits as needed. Adherence to regulatory and permit requirements and Energy Harbor administrative controls will minimize or avoid impact to terrestrial species. Therefore, cumulative impacts of climate change and PNPP activities on terrestrial species would be SMALL.

4.12.6 Historic and Cultural Resources

As presented in Section 4.7, Energy Harbor has administrative controls in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. As discussed in Section 3.8.6, PNPP has a procedure specific to ground-disturbing activities that requires disruptive activity at the site be halted and PNPP staff be notified if any archeological areas are identified during construction or other land-disturbing activities.

Established processes address the potential for impacts on cultural resources by establishing procedures for all activities that require a federal permit or use federal funding and have the potential to impact historic resources. Therefore, no historic properties will be affected during the proposed LR operating term. Section 4.7 also discussed the potential for continued operation of PNPP to affect cultural resources in the surrounding area and concluded that the physical or historical integrity of these sites will not be affected. Therefore, PNPP is not anticipated to contribute cumulative impacts to historic and cultural resources.

4.12.7 Socioeconomics

As discussed in Section 2.5, the proposed LR does not include plans to add permanent workers, so the SMALL adverse impacts that are the result of workers' impact on community services, education, and infrastructure including transportation would not change. As discussed in Section 3.9.5, Energy Harbor's annual property tax payments are expected to remain relatively constant throughout the license renewal term. The economic contributions of the plant's workers would remain the same. Thus, significant beneficial socioeconomic impacts would also continue during the proposed LR operating term.

4.12.8 Human Health

Radiological dose limits for protection of the public and workers have been developed by the EPA and the NRC to address the cumulative impacts of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 10 CFR Part 20 and 40 CFR Part 190. For this analysis, the region of influence is the surrounding 50-mile region.

As presented in Section 3.10, PNPP prepares annual radiological environmental operating reports and annual radiological effluent reports. The reports for 2016–2021 indicate that doses to members of the public were controlled within NRC and EPA radiation protection standards. Occupational exposure at nuclear power plants is monitored by the NRC. The 3-year (2017–2019) average annual occupational dose (TEDE) was 0.228 rem. The annual TEDE limit is 5 rems [10 CFR 20.1201(a)(1)].

The only other NRC-licensed operating nuclear power plants, fuel cycle facilities, or radiological waste treatment and disposal facilities within the 50-mile region of PNPP is Advanced Medical Systems approximately 35 miles southwest of PNPP and the Whittaker Corporation approximately 48 miles southeast of the plant. Both of these sites, are classified by the NRC as Complex Materials sites, are currently undergoing decommissioning (NRC 2022b).

Operating PNPP for an additional 20-year period would not cause an increase in annual radioactive effluent releases. The cumulative impact of PNPP's Unit 1 operation, and the decommissioning activities in the region, would be expected to be SMALL because the plant and ISFSI are designed to maintain doses ALARA, and all routine releases and occupational exposure would be subject to federal regulations.

As for non-radiological human health impacts, as pointed out in Section 4.9.1.4, PNPP operations occur with temperatures below the temperatures optimal to grow pathogens.

Therefore, it is unlikely to pose a risk to human health. Compliance with NESC and PNPP procedures minimize occupational risk from electrical shock hazards (Section 4.9.2.4). As described in Section 3.10.2, PNPP maintains a comprehensive industrial safety program. Therefore, cumulative impacts to human health from non-radiological hazards are not expected.

The cumulative impacts on human health are expected to be SMALL.

4.12.9 Waste Management

As presented in Section 4.11.1.1 of the GEIS, the comprehensive regulatory controls in place for management of radiological waste and Energy Harbor's compliance with these regulations and use of only licensed treatment and disposal facilities would allow the impacts to remain SMALL during the proposed LR operating term. The NRC oversees the licensing of radiological waste treatment and disposal facilities. There are four facilities providing LLRW disposal services in the United States (NRC 2017). As discussed in Section 3.10, PNPP's annual reports for 2016–2020 indicate that radiological doses to members of the public were controlled within NRC and EPA radiation protection standards. There are no other operating nuclear power plants, fuel cycle facilities, or radiological waste treatment and disposal facilities within the 50-mile region of PNPP. Two complex materials sites (Advanced Medical Systems and Whittaker Corporation) are undergoing decommissioning (NRC 2022b).

PNPP has programs in place to manage its hazardous and nonhazardous waste streams. PNPP also ensures that only licensed or permitted facilities are used for treatment and disposal of its waste streams. Continuation of existing systems and procedures to ensure proper storage and disposal during the proposed LR operating term would allow the impacts to be SMALL. The two complex materials facilities within the 50-mile region of PNPP are also required to comply with appropriate EPA and state requirements for the management of radioactive and non-radioactive wastes. Thus, the cumulative waste management impact would be SMALL.

4.13 Impacts Common to all Alternatives: Uranium Fuel Cycle

Impacts to the uranium fuel cycle are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to uranium fuel cycle. Therefore, Energy Harbor incorporates the NRC finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

4.14 Termination of Nuclear Power Plant Operations and Decommissioning

Impacts to the termination of nuclear power plant operations and decommissioning are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1. Energy Harbor conducted a new and significant information review and identified no new and significant information related to termination of nuclear power plant operations and decommissioning. Therefore, Energy Harbor incorporates the NRC finding from 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

4.15 Postulated Accidents

This section describes environmental impacts from postulated accidents that might occur during the period of extended operation. The term "accident" refers to any unintentional event outside the normal plant operational envelope that results in a release or the potential for release of radioactive materials into the environment. Two classes of postulated accidents are evaluated in NUREG–1437, GEIS for License Renewal of Nuclear Plants (NRC 1996b). These are design-basis accidents (DBAs) and severe accidents.

4.15.1 Design-Basis Accidents

The following Category 1 issue related to postulated accidents was reviewed for applicability to PNPP: Issue 65—Design-basis accidents.

PNPP is required to maintain the plant within acceptable design and performance criteria, including during any license renewal term. Impacts from design-basis accidents would not be affected by changes in plant environment because such impacts (1) are based on calculated radioactive releases that are not expected to change; (2) are not affected by plant environment because they are evaluated for the hypothetical maximally exposed individual; and (3) have been previously determined acceptable.

Experience at PNPP has contributed to improved plant performance as measured by trends in plant-specific performance indicators, a reduction in operating events, and lessons learned that improve the safety of all the operating nuclear power plants. This is also confirmed by analysis which indicates that, in many instances, improved plant performance and design features have resulted in reductions in initiating event frequency, core damage frequency (CDF), and containment failure frequency.

4.15.2 Severe Accidents

The following Category 2 issue (requirement) related to severe accidents has been defined by the NRC in 10 CFR 51.53(c)(3)(ii)(L):

> *If the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided.*

Since PNPP has not formally submitted any severe accident mitigation alternatives (SAMA) in association with an environmental assessment, they must be considered as a part of this aspect of the licensing renewal. The NRC finding regarding severe accidents is stated in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, as follows:

The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.

In accordance with the requirement, PNPP reviewed prior industry-identified SAMAs, as well as new PNPP-specific SAMAs and identified those where a cost-benefit assessment is required.

4.15.3 Severe Accident Mitigation Alternatives

If the NRC staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, 10 CFR 51.53(c)(3)(ii)(L) requires that license renewal applicants consider alternatives to mitigate severe accidents. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not previously been considered for PNPP; therefore, the remainder of this section addresses those alternatives.

4.15.3.1 Overview of SAMA Process

This section summarizes the PNPP analysis of alternatives for mitigating the impacts of severe accidents. Attachment G provides a detailed description of the SAMA Analysis.

NEI 05-01 guidance was used to identify SAMAs applicable for PNPP and to provide both qualitative (Phase I) and quantitative (Phase II) screening based on specific criteria (NEI 2005). Phase I of the guidance is to develop potential SAMAs applicable to the PNPP site that may provide adequate benefit. The initial listing of potential SAMAs was developed using available generic industry identification of SAMAs (NRC 1996b). These SAMAs are qualitatively screened out using the guidance provided in NEI 05-01 (NEI 2005). This included addressing the first three steps of the Phase I analysis.

Additionally, plant-specific SAMAs were identified using a prior internal evaluation, updated with input from the PNPP expert panel. The plant-specific SAMAs were evaluated in a similar manner as described for the generic SAMAs.

After completion of the first three qualitative screening steps in Phase I as described in NEI 05-01 (NEI 2005), the unscreened SAMAs, both generic and plant-specific, were grouped together where possible. From this qualitative analysis and grouping process, twelve SAMA groups were identified. Steps 4 and 5 of the Phase I guidance was performed for the remaining twelve SAMA candidates. To support a more robust assessment, quantitative measures were developed to support these qualitative steps of Phase I. Implementation of the five steps in the Phase I guidance resulted in all but two SAMA candidates being screened out. These two SAMAs were passed to the next step in the NEI 05-01 process involving quantitative screening (NEI 2005).

Phase II involves quantitative assessment of cost benefit. To develop the cost estimate and risk model, it was necessary to develop a conceptual implementation of the proposed SAMA in a manner that achieves the same improvement for the PNPP site as proposed by the SAMA group. From this concept, the cost estimate is generated and the changes to the PNPP Probabilistic Risk Assessment (PRA) model are defined. The costing process and the proposed design were developed based on input and review from the PNPP expert panel. Phase II requires a Level 3 PRA to support the averted cost-risk calculations (NEI 2005).

The Level 3 PRA model developed the dose estimates. The Level 3 model utilizes the Level 2 PRA frequency and deterministic outputs and includes updates to the population density within 50 miles of the PNPP site, economic data reflecting recent cost data, meteorological data, and plant emergency response information (detailed in Attachment G) as input to Version 3.10.0 of the Windows Interface for MELCOR Accident Consequence Code System 2 (MACCS2). The model inputs are based on nuclide release information that reflects the current fission product inventory and frequency information for plant source term categories (STCs).

SAMA candidates that were not screened out in Phase I were evaluated in detail and the resultant risk benefit compared to the implementation cost. A SAMA candidate screened out if the implementation cost exceeded the detailed analysis risk benefit. Any SAMA candidate that was found to be beneficial would progress to a more detailed cost benefit assessment and potential implementation.

4.15.3.2 Estimate of Risk

The PNPP PRA model of record forms the basis for the consequence assessment. The model has been updated several times since completion of the individual plant examination (IPE) to maintain consistency with the as-built plant, to incorporate improved thermal hydraulic results, and to incorporate PRA improvements. The updates have involved a cooperative effort, including both licensee personnel and PRA consultant support. An internal independent review of revisions to the PRA model is performed. The PRA model and results have been maintained, and the current model incorporates all plant improvements until April 2021. Energy Harbor reviewed the PNPP PRA for the relevant attributes of the PRA with respect to the application of NEI 05-01 (NEI 2005). The findings are summarized in Table 4.15-2. The PNPP PRA quantification metrics used to support the SAMA assessment are summarized in Table 4.15-3 and are developed using the PNPP Level 2 PRA model.

Attachment G provides a detailed description of the SAMA analysis including PNPP PRA quantification metrics used to support the SAMA assessment.

4.15.3.3 Potential Plant Improvements

In the Phase I screening, the potential SAMAs were qualitatively screened and grouped with bounding potential SAMAs for further quantitative evaluation based on the MB criterion.

The industry SAMA review identified 129 potential SAMAs candidates. The plant-specific assessment re-evaluated the 25 PNPP draft SAMA candidates previously evaluated. Three additional SAMA candidates were identified by the PNPP expert panel for a total of 157 SAMAs identified for consideration. Qualitative screening as defined in Phase I of NEI 05-01 (NEI 2005) screened out all but two of the candidate SAMAs. The two unscreened SAMA candidates were carried forward to Phase II for quantitative evaluation. Attachment G provides a detailed description of the SAMA analysis, including the Phase II cost-benefit analysis of the twelve potential plant improvements in Table 4.15-1.

4.15.4 Conclusions

The analysis considered a total of 157 SAMAs identified from industry studies and plant-specific examination as potential candidates for severe accident mitigation. The qualitative Phase I screening eliminated 155 SAMA candidates from further consideration. The two SAMA candidates were retained for quantitative cost benefit assessment.

The benefit from the remaining two candidates (SAMA 11 and SAMA 17) was quantified. When compared to the implementation cost, the benefit from implementation was found not to be cost beneficial and both SAMAs were screened out. As a result of this evaluation, all potential SAMAs were screened out (Attachment G).

Table 4.15-1 SAMA Cases for Phase II Quantitative Evaluation

PNPP SAMA Case	SAMA Case Description	Assessment	Generic Case (if applicable)
SAMA-11	This SAMA would provide alternate cooling to the EDG Rooms. The cooling would dissipate heat generated by the Emergency Diesel Generators in the event of a loss of normal cooling.	This SAMA is not cost beneficial. However, several other sites have identified this as an important SAMA. Therefore, it is retained for assessment.	EDG_HVAC
SAMA-17	Develop procedures to repair or replace failed 4-kV breakers.	The original SAMA case involved reset of failed 4-kV breakers. This is like controlling seismic failures related to relay chatter of power relays leading to a loss of ac power. The scenario is also like the impact of flooding on the safety-related switchgear. Both of these contributors are significant, and the SAMA is retained for assessment.	BRK_REPAIR

Table 4.15-2 Assessment of the PNPP PRA Acceptability (Sheet 1 of 2)

Topic	Assessment
Internal Events Model	The PNPP PRA model fault tree represents a Level 1, LERF and Level 2, internal events, and internal flood PRA with the plant at full power. The PRA Model is the most recent integrated internal events/internal flooding risk model, containing all implemented plant changes, and updated failure and unavailability data through April 2021.. An Open Facts and Observations (F&Os) closure review was held in October 2017 and the open F&Os were closed in February 2018. No open F&Os are identified in the closure activity for internal events or internal flooding.
Consideration of External Hazards	The PNPP PRA includes a detailed seismic hazard assessment based on the internal events model and represents Level 1, LERF and Level 2. The F&O closure activity for the seismic model conducted in October 2017 closed all but one open F&O and concluded that the one open F&O did not cause any conservatism or bias that would question the technical adequacy of the seismic PRA in support of risk-informed decision making. The assessment of internal fire events is provided by the individual plant examination for external events (IPEEE) assessment using the EPRI FIVE methodology. The approach was adequate to identify any significant vulnerabilities and the risk from internal fire is considered addressed through implementation of the PNPP fire protection program which generally complies with the requirements of 10 CFR 50 Appendix R and NRC BTP 9.5-1. Therefore, no SAMA improvements are necessary with respect to internal fire and this hazard is not addressed in the SAMA assessment. The external hazards assessment is dominated by the current seismic results. Other external hazards would not be significant contributors and are bounded by the current seismic hazard estimates.
Source Term Modeling	Updated analyses were performed using the Modular Accident Analysis Program to estimate source terms and an updated Level 3 model using MACCS2 was created as a part of the SAMA assessment activity.
Power Uprate and Fuel Burnup	Power uprates and/or changes in fuel burn up are incorporated in the current PNPP PRA model and the model reflects the current plant fuel configuration.
Consideration of Low Power and Shutdown Events	The environmental impacts from accidents at low power and shutdown conditions are generally comparable to those from accidents at full power when comparing the values in NUREG/CR-6143 and NUREG/CR-6144 to those in NUREG-1150 (NRC 1990; NRC 1994; NRC 1995). Therefore, the environmental impact of severe accidents bound the potential impacts from accidents at low power and shutdown. Finally, as cited above and discussed in SECY-97-168, industry initiatives taken during the early 1990s have also contributed to the improved safety of low power and shutdown operation.

Table 4.15-2 Assessment of the PNPP PRA Acceptability (Sheet 2 of 2)

Topic	Assessment
Consideration of Spent Fuel Pool Accidents	The environmental impacts from accidents at spent fuel pools (as quantified in NUREG-1738) can be comparable to those from reactor accidents at full power (as estimated in NUREG-1150). Subsequent analyses performed, and mitigative measures employed, since 2001 have further lowered the risk of this class of accidents. In addition, post-Fukushima modifications have increased the robustness of the spent fuel pool systems. Conservative estimates from NUREG-1738 of impacts are much less than the impacts from full power reactor accidents evaluated for PNPP.
Level 2 Model	The Level 2 model is integrated with the Level 1 model into a single model that is consistent with the as-built plant, to incorporate improved thermal hydraulic results, and to incorporate PRA improvements since the development of the IPE and IPEEE. An F&Os closure review was held in October 2017 and the open F&Os were closed. No open items are identified in that closure activity for the Level 2 model.
Level 3 Model	The Level 3 model is based on MACCS2 and includes updates to the population density within 50 miles of the PNPP site, economic inputs reflecting recent cost data, meteorological data (wind speed, wind direction, atmospheric stability, accumulated precipitation, and atmospheric mixing heights), and plant emergency response. The model inputs are based on nuclide release information that reflects the current fission product inventory and frequency information for plant STCs (detailed in Attachment G).

Table 4.15-3 PNPP PRA Core Damage, Large Early Release Frequency and Population Dose

Hazard	Core Damage Frequency (/y)	Large Early Release Frequency (/y)	Population Dose (MR/y)
Internal Events and Internal Flooding	1.32E-6	1.88E-7	1.70E+1
Seismic	1.46E-5 (91.7%)	5.19E-6 (96.5%)	2.78E+2 (94.2%)
Total	1.59E-5	5.38E-6	2.95E+2

Note: The values in parenthesis represent the contribution to the metric from the seismic hazard.

5.0 NEW AND SIGNIFICANT INFORMATION

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware [10 CFR 51.53(c)(3)(iv)]. The NRC has stated however that an applicant is not required to perform site-specific validation of GEIS conclusions (NRC 1996c).

License renewal applicants are required to analyze only those issues the NRC has not resolved generically. While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of those Category 1 environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware [10 CFR 51.53(c)(3)(iv)].

5.1 New and Significant Information Discussion

The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b). In this guidance, new and significant information is defined as follows:

> (1) Information that identifies a significant environmental impact issue that was not considered or addressed in the GEIS and consequently, not codified in Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants," in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)," of 10 CFR Part 51; or
>
> (2) Information not considered in the assessment of impacts evaluated in the GEIS leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.
>
> (3) Further, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

Based on available guidance and the definitions of SMALL, MODERATE, and LARGE impacts provided by NRC in 10 CFR Part 51, Appendix B, Table B-1, Footnote 3, Energy Harbor considers any new information regarding Category 1 issues with MODERATE or LARGE impacts would be significant. Section 4.0.2 presents the NRC's definitions of SMALL, MODERATE, and LARGE.

5.2 Energy Harbor's New and Significant Information Review Process

The new and significant information assessment described below meets or addresses regulatory guidance provided above.

Energy Harbor's process is collectively carried out through its ongoing environmental planning, assessment, monitoring, and compliance activities performed by corporate and PNPP management and staff and ER-specific reviews. This team has collective knowledge of the license renewal process, the PNPP site, licensing and permitting, environmental and regulatory issues, initial license renewals, the NEPA process, and other nuclear industry activities which could potentially provide new and significant information.

Energy Harbor's new and significant information review included identification of applicable and non-applicable Category 1 issues through:

- Review of the GEIS for its Category 1 discussions;
- Identification and review of past or potential modifications to PNPP, including environmental impacts; and
- Identification and assessment of equipment and operations with the potential to result in changes in emissions, releases, discharge points, land use, noise levels, etc., considering environmental reviews since initial license issuance, and those anticipated during the proposed license renewal term.

Energy Harbor applied an investigative process for purposely seeking new information related to the Category 1 environmental issues through:

- Environmental review team discussions with Energy Harbor and PNPP subject matter experts on the Category 1 issues as they relate to the plant;
- Review of permits and reference materials related to environmental issues at the plant, the environmental resource areas related to Category 1 issues, and information collected for regulatory compliance status;
- Review of recent publicly available information, or information held by Energy Harbor, particularly data or reports from the past five years, related to the resource area and each applicable Category 1 impact issue, as summarized in the appropriate section of the LR ER in Chapter 3.0, Affected Environment;
- Review of environmental monitoring and reporting required by regulations related to the PNPP site and operations;
- Review of Energy Harbor environmental programs and procedures related to the PNPP site and operations;
- Review of correspondence and permitting documentation related to oversight of PNPP facilities and operations by state and federal regulatory agencies (activities that would

bring significant issues to the plant's attention), to identify site-specific environmental concerns; and

- Review of previous initial and subsequent license renewal applications for issues relevant to this PNPP LR application.

In addition, Energy Harbor is made aware of and stays abreast of new and emerging environmental issues and concerns on an ongoing basis through:

- Review of nuclear industry publications, operating experience, and participation in nuclear industry organizations;
- Contact with state and federal resource agencies with regulatory jurisdiction over environmental regulation; and
- Development and periodic review of regulatory guidance procedures that address ongoing and emergent issues.

Information resulting from the information-seeking process was assessed to determine if it is new, and/or significant, applying the following considerations:

- Was the information included in or available for the GEIS analysis of the Category 1 issue?
- Does the information identify an environmental issue not generically considered in the GEIS, and consequently, not codified in 10 CFR 51 Appendix B Table B-1?
- Does the information present a seriously different picture of the environmental consequences of the action than previously considered, leading to an impact finding different from that included in the GEIS or codified in regulation?
- Does the information involve a new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity (MODERATE or LARGE) and/or scope (context) not previously recognized?

5.3 Energy Harbor's New and Significant Information Review Results

As a result of this review, Energy Harbor is aware of no new and significant information regarding the environmental impacts of LR associated with PNPP. The findings in NUREG-1437, Revision 1 for the applicable Category 1 issues are therefore incorporated by reference. New and significant information review methodology and results applicable to the issue of severe accidents, which is the functional equivalent of a Category 1 issue for PNPP, are addressed separately in Section 4.15 (NRC 2013d).

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 License Renewal Impacts

Chapter 4 incorporates by reference NRC findings for the 53 Category 1 issues that apply to PNPP, all of which have SMALL environmental impacts. In addition, Chapter 4 presents site-specific analyses of the nine Category 2 issues. Table 6.1-1 identifies the environmental impacts that renewal of the PNPP OL would have on resources associated with Category 2 issues.

Energy Harbor has reviewed the environmental impacts of renewing the PNPP OL and concluded that further mitigation measures beyond those presented in Section 6.2 and listed in Table 6.1-1 of this ER to avoid, reduce the severity of, or eliminate adverse impacts are not warranted. This ER documents the basis for Energy Harbor's conclusion.

Table 6.1-1 Environmental Impacts Related to License Renewal at PNPP (Sheet 1 of 4)

Resource Issue	ER Section	Environmental Impact
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.1	No impact. Issue is not applicable because PNPP utilizes a closed-cycle cooling system with a natural draft cooling tower, service and makeup water are obtained from Lake Erie and not a river.
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute) [10 CFR 51.53(c)(3)(ii)(C)]	4.5.3	No impact. Issue is not applicable because PNPP does not withdraw groundwater.
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.2	No impact. Issue is not applicable because PNPP utilizes a closed-cycle cooling system that withdraws makeup water from Lake Erie, not a river.
Groundwater quality degradation (plants with cooling ponds at inland sites) [10 CFR 51.53(c)(3)(ii)(D)]	4.5.4	No impact. Issue is not applicable because PNPP uses a closed-cycle cooling system and does not utilize cooling ponds.
Radionuclides released to groundwater [10 CFR 51.53(c)(3)(ii)(P)]	4.5.5	SMALL impact. Water for station use continues to be processed and monitored in compliance with licensing and permitting resulting in SMALL impacts and do not warrant additional mitigation measures.
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts) [10 CFR 51.53(c)(3)(ii)(E)]	4.6.5	SMALL impact. No refurbishment or other LR-related construction activities have been identified; adequate management programs and regulatory controls in place to prevent impacts outside of previously disturbed areas.
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.4	No impact. Issue is not applicable because PNPP withdraws makeup water from Lake Erie and not from a river.

Table 6.1-1 Environmental Impacts Related to License Renewal at PNPP (Sheet 2 of 4)

Resource Issue	ER Section	Environmental Impact
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.1	No impact. Issue is not applicable because PNPP utilizes a closed cycle cooling system that draws from and discharges to Lake Erie.
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.2	No impact. Issue is not applicable because PNPP utilizes a closed cycle cooling system that draws water from and discharges to Lake Erie.
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.3	No impact. Issue is not applicable because PNPP withdraws makeup water from Lake Erie and not from a river.
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat [10 CFR 51.53(c)(3)(ii)(E)]	4.6.6	NO EFFECT to MAY AFFECT BUT IS NOT LIKELY TO ADVERSELY AFFECT. No refurbishment or other LR-related construction activities have been identified. The continued operation of the site would range from no effect to may affect but is not likely to adversely affect any federally or state-listed threatened, endangered, and protected species, and essential fish habitat.
Historic and Cultural Resources		
Historic and cultural resources [10 CFR 51.53(c)(3)(ii)(K)]	4.7	No adverse effects on historic properties. No refurbishment or other LR-related construction activities have been identified; administrative procedural controls ensure protection of these type of resources in the event of ground-disturbing activities.

Table 6.1-1 Environmental Impacts Related to License Renewal at PNPP (Sheet 3 of 4)

Resource Issue	ER Section	Environmental Impact
Human Health		
Microbiological hazards to the public (plant with cooling ponds or canals or cooling towers that discharge to a river) [10 CFR 51.53(c)(3)(ii)(G)]	4.9.1	SMALL impact. Conditions necessary for optimal growth of pathogens are limited by water temperature in the discharge area and public access is restricted by the security control of the protected area. Therefore, the public human health risk posed by PNPP's thermal discharge's capacity to enhance thermophilic microorganisms is SMALL.
Electric shock hazards [10 CFR 51.53(c)(3)(ii)(H)]	4.9.2	SMALL impact. PNPP in-scope transmission lines are in compliance with NESC clearance guidelines. Work on and near the transmission lines is governed by plant procedures. Given these conditions, the human health impact from electric shock hazards during the proposed LR operating term would be SMALL.
Postulated Accidents		
Severe accidents [10 CFR 51.53(c)(3)(ii)(L)]	4.15.1	SMALL impact. Utilizing appropriate qualitative screening criteria many of the industry and new PNPP-specific SAMAs were eliminated from consideration. The remaining SAMAs were evaluated quantitatively, and none of the unscreened candidate SAMAs would reduce the PNPP maximum benefit by fifty percent or are cost beneficial to implement.
Environmental Justice		
Minority and low-income populations [10 CFR 51.53(c)(ii)(N)]	4.10.1	No disproportionately high and adverse impacts or effects on minority and low-income populations identified.

Table 6.1-1 Environmental Impacts Related to License Renewal at PNPP (Sheet 4 of 4)

Resource Issue	ER Section	Environmental Impact
Cumulative Impacts		
Cumulative Impacts [10 CFR 51.53(c)(ii)(O)]	4.12	SMALL adverse to SMALL beneficial impacts. SMALL for land use and visual resources, air quality and noise, geology and soils, surface water, terrestrial and aquatic and ecological resources, human health, climate change, and waste management. SMALL adverse to SMALL beneficial for socioeconomics. No impact for ground water and historic and cultural resources.

6.2 Mitigation

6.2.1 Requirements [10 CFR 51.45(c) and 10 CFR 51.53(c)(3)(iii)]

The environmental report must include an analysis that considers and balances … alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]

The report must contain a consideration of alternatives for reducing adverse impacts … for all Category 2 license renewal issues…. [10 CFR 51.53(c)(3)(iii)]

6.2.2 Energy Harbor Response

NRC Regulatory Guide 4.2, Supplement 1, Revision 1, specifies that the applicant should identify any ongoing mitigation and address the potential need for additional mitigation. Applicants are only required to consider mitigation alternatives in proportion to the significance of the impact. (NRC 2013b)

As discussed in Section 6.1, impacts associated with the proposed PNPP LR do not require the implementation of additional mitigation measures. The permits and programs presented in Chapter 9 (i.e., NPDES permit; stormwater program; air permit; spill prevention, control, and countermeasure (SPCC) plan; hazardous waste management program; cultural resource description process; and environmental review programs) that currently mitigate the operational environmental impacts of PNPP are adequate. Therefore, additional mitigation measures are not sufficiently beneficial as to be warranted.

6.3 Unavoidable Adverse Impacts

6.3.1 Requirement [10 CFR 51.45(b)(2)]

The environmental report shall … discuss … any adverse environmental effects which cannot be avoided should the proposal be implemented …. [10 CFR 51.45(b)(2)]

6.3.2 Energy Harbor Response

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the facility is in existence at the license renewal stage and has already operated for years. As a result, adverse impacts associated with the initial construction have been avoided, mitigated, or already occurred.

As discussed in Chapter 4, Energy Harbor does not anticipate the continued operations of PNPP to adversely affect the environment. Energy Harbor also does not anticipate any LR-related refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process. Therefore, the environmental impacts to be evaluated for LR are those associated with continued operation during the renewal term.

Energy Harbor adopts by reference the NRC findings for the 53 Category 1 issues applicable to PNPP, including discussions of any unavoidable adverse impacts (NRC 2013a). In addition, Energy Harbor identified the following site-specific unavoidable adverse impacts associated with PNPP:

- The majority of the land use at PNPP would continue to be designated as industrial until the plant is shut down and decommissioned (decommissioning can take up to 60 years after permanent shutdown of PNPP).
- As discussed in Section 3.6.1.2, normal plant operations result in industrial wastewater discharges containing small amounts of water treatment chemical additives to Lake Erie at or below approved OEPA concentrations. Compliance with the NPDES permit (Attachment B) would ensure that impacts remain SMALL.
- As discussed in Section 3.6.3.1, plant operation of PNPP results in consumptive water use of Lake Erie, PNPP uses a closed cycle cooling system that withdraws and discharges cooling water to the lake with minimal net loss.
- Operation of PNPP results in the generation of spent nuclear fuel and waste material, including LLRW, hazardous waste, and nonhazardous waste. Specific plant design features in conjunction with a waste minimization program, employee safety training programs and work procedures, and strict adherence to applicable regulations for storage, treatment, transportation, and ultimate disposal of this waste ensure that the impact is SMALL.
- Operation of PNPP results in a very small increase in radioactivity in the air and water emissions. The incremental radiation dose to the local population resulting from PNPP operations is typically less than the magnitude of the fluctuations that occur in natural background radiation. Doses to the public from PNPP’s gaseous releases would be well within the allowable limits of 10 CFR Part 20 and 10 CFR Part 50, Appendix I. Operation of PNPP also creates a very low probability of accidental radiation exposure to inhabitants of the area.

6.4 Irreversible or Irretrievable Resource Commitments

6.4.1 Requirement [10 CFR 51.45(b)(5)]

The environmental report shall … discuss … any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. [10 CFR 51.45(b)(5)]

6.4.2 Energy Harbor Response

The term “irreversible” applies to the commitment of environmental resources (e.g., permanent use of land) that cannot by practical means be reversed to restore the environmental resources to their former state. In contrast, the term “irretrievable” applies to the commitment of material resources (e.g., irradiated steel, petroleum) that, once used, cannot by practical means be recycled or restored for other uses. The continued operation of PNPP for the proposed LR operating term will result in irreversible and irretrievable resource commitments, including the following:

- Uranium in the nuclear fuel consumed in the reactor that becomes high-level radioactive waste if the used fuel is not recycled through reprocessing.
- Land required for permanent storage or disposal of spent nuclear fuel, LLRW generated as a result of plant operations, and sanitary waste generated from normal industrial operations.
- Elemental materials that will become radioactive.
- Materials used for the normal industrial operations of PNPP that cannot be recovered or recycled, or that are consumed or reduced to unrecoverable forms.

No LR-related refurbishment activities have been identified that would irreversibly or irretrievably commit significant environmental components of land, water, and air.

If PNPP ceases operations on or before the expiration of the current OL, the likely power generation alternatives would require a commitment of resources for construction of the replacement plant as well as for fuel to run the plant. Significant resource commitments would also be required if transmission lines are needed to connect a replacement generation plant to the electrical grid.

6.5 Short-Term Use Versus Long-Term Productivity of the Environment

6.5.1 Requirement [10 CFR 51.45(b)(4)]

The environmental report shall … discuss … the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity …. [10 CFR 51.45(b)(4)]

6.5.2 Energy Harbor Response

The current balance between short-term use and long-term productivity of the environment at the site has remained relatively constant since PNPP began operations. The Final Environmental Statement (FES) for PNPP evaluated the relationship between the short-term uses of the environment and the maintenance and enhancement of the long-term productivity associated with the construction and operation of PNPP (NRC 1982). The proposed LR operating term will not alter the short-term uses of the environment from the uses previously evaluated in the PNPP FES. The proposed LR operating term will postpone the availability of the site resources (land, air, water) for other uses. Denial of the application to renew the PNPP OL would lead to the shutdown of the plant and would alter the balance in a manner that depends on the subsequent uses of the site. For example, the environmental consequences of turning the site area occupied by PNPP into a park or an industrial facility after decommissioning are quite different. Extending PNPP operations would not alter, but only postpone, the potential long-term uses of the site that are currently possible.

No LR-related refurbishment activities have been identified that would alter the evaluation of the PNPP FES for the relationship between local short-term uses of man’s environment and the maintenance and enhancement of long-term productivity of these resources.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

The environmental report shall . . . discuss . . . alternatives to the proposed action . . . . [10 CFR 51.45(b)(3)]

The applicant shall discuss in this report the environmental impacts of alternatives and any other matters . . . . The report is not required to include discussion of need for power or economic costs and benefits of . . . alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation . . . . [10 CFR 51.53(c)(2)]

A reasonable alternative must be commercially viable on a utility scale and operational prior to the expiration of the reactor's operating license, or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactor's operating license . . . . The amount of replacement power generated must equal the base-load capacity previously supplied by the nuclear plant and reliably operate at or near the nuclear plant's demonstrated capacity factor. (NRC 2013a GEIS, Section 2.3)

7.1 No Action Alternative

As described in Section 2.1, the proposed action is to renew the PNPP OL for an additional 20-year period. The only other alternative under consideration is the no-action alternative, which would be the decision *not* to renew the PNPP OL. If the PNPP OL is not renewed, the 1,175 MWe (net reliable generation) of baseload power would not be available for distribution in Ohio and other markets during the proposed LR operating term from 2026–2046. The no-action alternative will identify replacement power sources for the loss of PNPP generation.

In accordance with 10 CFR 51.53(b)(3), this ER will discuss a no-action alternative to the proposed OL renewal and a range of alternatives for replacement baseload power sources. A reasonable alternative as described by the NRC must be technically feasible and commercially viable on a utility scale and operational prior to the expiration of the reactor's renewed OL or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactor's renewed OL (NRC 2013a). The replacement power alternative generation must also provide adequate baseload power capacity that was previously supplied by the nuclear plant.

The replacement power sources being considered under the no-action alternative are presented in Section 7.2.1. Section 7.2.2 will identify the no-action alternative power sources evaluated that were not considered reasonable power sources for the replacement of the PNPP generation.

7.1.1 Decommissioning Impacts

The NRC's definition of decommissioning, as stated in 10 CFR 20.1003, is the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits the following:

- Release of the property for unrestricted use and termination of the license; or
- Release of the property under restricted conditions and termination of the license.

The NRC-evaluated decommissioning options include the following:

- Immediate dismantling soon after the facility closes.
- Safe storage and monitoring of the facility for a period of time that allows the radioactivity to decay, followed by dismantling and additional decontamination.
- Permanent entombment on the site in structurally sound material such as concrete that is maintained and monitored.

All the decommissioning options must be completed within a 60-year period following permanent cessation of operations and permanent removal of fuel.

Under the no-action alternative, Energy Harbor would continue operating PNPP until the existing OL expires. Upon expiration of the OL, Energy Harbor would initiate decommissioning procedures in accordance with NRC requirements. The NRC GEIS evaluated decommissioning environmental impacts for land use, visual resources, air quality, noise, geology and soils, hydrology, ecology, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management and pollution prevention. Energy Harbor considers the GEIS description of decommissioning impacts as representing the actions it would perform for the PNPP decommissioning (NRC 2013a). Therefore, Energy Harbor relies on the NRC's conclusions regarding the environmental impacts of decommissioning PNPP.

Decommissioning and its associated impacts are not considered evaluation criteria used to proceed with the proposed action or select the no-action alternative. PNPP will be decommissioned eventually, regardless of the NRC decision on license renewal and license renewal will only postpone decommissioning for another 20 years. The GEIS states the timing of the decommissioning does not change the environmental impacts associated with this activity. The NRC's findings, as described in 10 CFR 51, Subpart A, Appendix B, Table B-1, state that delaying decommissioning until after the renewal term would result in SMALL environmental impacts. Energy Harbor relies on the NRC's findings.

The primary criteria used to evaluate the proposed action and the no-action alternative are the power options available for replacement of PNPP generation. Energy Harbor concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those following license renewal as identified in the GEIS. Decommissioning impacts would be SMALL and could overlap with operation of a PNPP replacement.

7.2 Energy Alternatives that Meet System Generating Needs

In accordance with 10 CFR 51.53(c)(2), Energy Harbor considered a range of alternatives to replace generation if the PNPP OL is not renewed. Energy Harbor considered each of the replacement alternatives identified in the GEIS for license renewal (NRC 2013a). These alternatives were evaluated based on their ability to provide reliable baseload power and to be operational prior to the expiration of the current OL.

7.2.1 Energy Alternatives Considered as Reasonable

A reasonable alternative as described by the NRC must be technically feasible and commercially viable on a utility scale and operational prior to the expiration of the reactor's OL or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactor's OL. The replacement power alternative generation must also provide approximately 1,175 Mwe net baseload power previously supplied by the nuclear plant. The alternatives analysis identified the following power sources as meeting the NRC criteria for reasonableness in the replacement of PNPP generation during the proposed LR operating term. These energy alternatives considered reasonable are further discussed in Section 7.2.3.

- Natural Gas Alternative –
    - Natural gas combined cycle combustion turbine located onsite
- Renewable and natural gas combination alternative –
    - Natural gas combined cycle combustion turbine located onsite
    - Solar panels with lithium-ion battery storage located offsite
    - Wind turbines located offsite

7.2.2 Energy Alternatives Not Considered Reasonable

The full range of energy alternatives as described in the GEIS include power sources that will require development of new generation and power alternatives that will not require new generation, such as purchased power (NRC 2013a). Energy Harbor considered all the alternatives described in the GEIS for replacement of the PNPP generation. This section will address the energy alternatives that were not considered reasonable for additional evaluation.

7.2.2.1 Purchased Power

Replacing all of the energy generation and capacity provided by PNPP with purchased power would introduce greater uncertainties in energy reliability that are not within Energy Harbor's control. Further, purchased power would be subject to competing power demand to secure firm power contracts adding to energy reliability concerns. The closure of coal-fired plants across the United States also changes the availability of baseload generation further introducing uncertainty for purchasing firm energy supply.

Potential environmental impacts associated with purchased power could be substantial and exceed the impacts associated with the continued operation of PNPP. Potential environmental impacts associated with purchased power would include those associated with the source of the generation and the transmission of the power into the regional grid. Fossil fuel generation results in air emissions, water use and quality issues, and land use impacts associated with the plant footprint. Renewable energy generation can have a large development footprint that can convert natural habitats to an industrial site. The conversion of forest and even agricultural lands to an industrial site can result in impacts to habitat that may adversely impact wildlife and plant species. Additional transmission capacity may be required to distribute electricity from renewable or fossil fuel generation and this may result in impacts to communities and lands within and adjacent to the corridor. These impacts could include loss of sensitive habitat, visual and view shed impairment, and degradation of wetlands and stream crossings.

Given the uncertainties associated with purchasing baseload power at the scale of PNPP's generation capacity on a long-term basis and the environmental impacts for developing new generation and transmission capacity, as well the operational impacts of fossil fuel generation, purchased power was not considered a reasonable discrete alternative.

7.2.2.2 Plant Reactivation or Extended Service Life

Energy Harbor has four other power plants within its fleet. Two are nuclear power plants: Beaver Valley and Davis-Besse. Beaver Valley Unit 1's OL expires in 2036 and Unit 2's in 2047 and Davis-Besse's OL expires in 2037 (NRC 2021). The coal-fired plants, W. H. Sammis and Pleasants Power Station, are slated for sale or closure in 2023.

Reactivating or continuing to operate coal-fired plants would result in much higher criteria air pollutant emissions than the operation of a nuclear power plant. Therefore, plant reactivation and extended service life is not considered a reasonable alternative because of the environmental impacts with continued use of fossil fuel-fired generation sources.

7.2.2.3 Conservation and Energy Efficiency Measures (Demand-Side Management)

Demand-side management (DSM) includes demand response that shifts electricity from a peak-use period to times of lower demand, and energy efficiency or conservation programs that reduce the amount of electricity required for existing activities and processes. A DSM alternative would be required to reduce the baseload demand by 1,175 Mwe to be considered a reasonable alternative. Reliance on DSM as a reasonable alternative to PNPP is uncertain because it relies on voluntary participation rather than mandatory energy efficiency from compliance with codes and standards (e.g., building codes and appliance energy use ratings) and realized savings of energy of need to replace PNPP's large capacity. Energy Harbor is a merchant generator and does not have a service territory with a customer base for which it is responsible for meeting their power needs, therefore there are no state policy or law requirements to implement DSM programs. As such, DSM is not a reasonable replacement alternative for PNPP.

7.2.2.4 New Nuclear

The time needed for licensing, constructing, and startup testing a replacement nuclear plant, whether conventional light-water reactor or small modular reactor, by PNPP's license expiration date provides enough uncertainty to not be a reasonable alternative.

7.2.2.5 Wind

The renewable and natural gas combination alternative includes a wind component. However, fully replacing PNPP's generating capacity with a discrete wind alternative would require more than one utility scale wind farm, effectively multiplying the potential environmental impacts, particularly the land use and terrestrial ecology impacts.

The land needs for wind generation include land parcel(s) that can host a wind farm where turbines are spaced for operation and linked with other turbines and with power converters and connections with transmission infrastructure. Within the wind farm acreage, land would be permanently disturbed for wind turbine bases and power infrastructure as well as temporarily disturbed for construction areas such as laydown and worker support areas. The USDOE developed three land use metrics for these acreage considerations — 85 acres per MW for wind farm boundaries, 2.47 acres per MW for construction footprint, and 0.74 acres per MW for permanent structures (DOE 2015). To replace 1,175 Mwe from PNPP with wind power would require about 2,800 Mwe based on the average wind generation capacity of 41.4 percent (DOE 2021). Based on the USDOE metrics, the acreage requirements are about 240,000 acres for wind farms, 7,000 acres for construction footprint, and 2,100 acres for permanent structures. To achieve the required MW capacity, the wind farm acreage would require many installations to bring together enough available land parcels, each with the potential to significantly impact land use even with the spaced wind turbines allowing for compatible uses such as crop cultivation.

Wind typically cycles significantly over a 24-hour period, is not dispatchable, and can experience low-capacity factors for several days at a time due to variable wind patterns. Therefore, wind generation by itself is not capable of providing baseload power. For a wind farm to replace a baseload energy source, capacity significantly in excess of PNPP generation coupled with large amounts of energy storage would have to be included for the facility. Installation of batteries to provide firm power, compensating for wind's intermittent nature, could further increase acreage requirements.

Other impacts from wind generation include impacts to terrestrial ecology from land disturbance and avian mortality from operations. Depending on the location of the wind facilities, the land use disturbances could result in moderate to large impacts on wildlife habitats, vegetation, land use, and aesthetics. Therefore, discrete wind would not be a superior alternative to continued operation of PNPP.

Ohio has potential for offshore wind in Lake Erie where wind resources range from 7.5 to 8.5 meters/second at 100 meters above the water surface (NREL 2014). Siting would require careful consideration to bathymetry, shipping lanes, fishing rights, wildlife migration patterns, and other environmental concerns. Wind installations also pose aesthetic impact concerns, and the larger turbines require greater offshore distances to minimize aesthetic impacts. There are currently no offshore wind installations on the Great Lakes. The first is anticipated to be the Icebreaker Wind demonstration project of 20.7 MW in Lake Erie offshore from Cleveland, Ohio, currently approved by the Ohio Power Siting Board (CL 2021).

7.2.2.6 Solar

The renewable and natural gas combination alternative includes a solar component. However, fully replacing PNPP's generating capacity with a discrete solar alternative would require several utility-scale solar installations, effectively multiplying the potential environmental impacts, particularly the land use and terrestrial ecology impacts. Solar generation is intermittent by nature, typically cycles significantly over a 24-hour period, is not dispatchable, and can experience low-capacity factors for several days at a time due to cloud cover. This type of generation volatility on a large scale can create distribution and/or transmission instability. For solar power to be viable as a discrete source of large amounts of energy that is reliably available for the regional grid at all hours of the day, capacity significantly in excess of the PNPP generation coupled with large amounts of battery storage or additional generation capacity would be needed to produce energy for storage.

Due to the amount of solar generating capacity needed to replace the entire PNPP baseload generation and the lower efficiencies in producing electricity from solar power versus nuclear power, the land acreage required for a discrete solar alternative is larger than, or similarly large as, other alternatives being considered in this ER. Using a capacity factor of 25 percent (EIA 2021a), replacing the 1,175 MW PNPP would require about 4,700 MW. The Ohio solar projects approved and under review by the Ohio Power Siting Board in 2021 had an average land use factor of 8 acres per MW (FD 2021). Using the 8 acres per MW assumption, 37,000 acres would be required to replace PNPP with solar. Furthermore, installation of batteries to provide firm power, compensating for solar's intermittent nature, could further increase acreage requirements. To acquire this much acreage through purchase or lease would require many installations, each with the potential to significantly impact land use. Depending on the location of the solar facilities, the land use disturbances could result in moderate to large impacts on wildlife habitats, vegetation, land use, and aesthetics. Therefore, discrete solar would not be a superior alternative to continued operation of PNPP.

A solar alternative using distributed solar involving solar panels installed on residential and commercial buildings would avoid the land use impacts. Such a distributed system would rely on the participation of the property owners and would have the same uncertainties as discussed in Section 7.2.2.3 for DSM. Reliance on distributed rooftop solar as a reasonable alternative to PNPP is uncertain because it relies on voluntary participation and requires compliance with codes and standards (e.g., building codes and property covenants) and realized reduced consumption at those properties as well as extra energy being fed back to the regional grid. The National Renewable Energy Laboratory (NREL) developed estimates for the potential generating capacity of solar photovoltaic (PV) panels that could be installed on residential and commercial properties in each state. NREL's estimate for Ohio is 55,136,084.08-megawatt hours (MWh) (NREL 2021). To fully replace PNPP generation with distributed solar on rooftops requires approximately 19 percent of the available rooftop space for the entire state of Ohio. Moreover, the NREL cautions that its estimation could be overestimating the available rooftop space -- "The technical generation potential of residential and commercial rooftop PV provides an upper bound of feasible development potential for planning purposes. Technical generation potential does not consider economic or market feasibility. The technical generation potential of residential and commercial rooftop PV is estimated by combining modeled suitable rooftop area with solar resource availability and quality and system performance data . . . Technical potential does not account for existing systems." (NREL 2021) Thus, if the available space was overestimated, distributed solar could require well over 19 percent of all the Ohio rooftop space available. Given the uncertainties in and impractical rooftop requirements for implementation of distributed solar on the required scale, distributed solar is not a reasonable replacement alternative for PNPP.

7.2.2.7 Combination of Wind and Solar

As stated above in Sections 7.2.2.5 and 7.2.2.6, the renewable and natural gas combination alternative includes wind and solar components along with a natural gas-fired plant. This section presents an alternative of multiple wind facilities and multiple solar facilities to cumulatively provide full replacement for the PNPP generation. In addition, to provide full replacement, the facilities would require battery storage. Energy Harbor considered a range of scenarios to understand the land use impact of such a renewable and natural gas combination alternative including combinations of 70 percent of replacement being provided by wind and 30 percent by solar, 50 percent from each, and 30 percent from wind and 70 percent from solar. For simplicity, it is assumed that battery storage at each site could be accommodated within the acreage footprint of the wind or solar facility. The capacity factors of 41.4 percent and 25.0 percent for wind and solar facilities, respectively, were used. There would be an additional land need for transmission connections for the new wind and solar facilities. Energy Harbor assumes 25 miles of new 345-kV transmission lines in a new 150-foot-wide ROW transmission corridor would need to be developed to support each solar and wind installation, an acreage requirement of 455 acres for each facility. The table below presents the disturbed acreage for the three scenarios. The disturbed acreage accounts for the permanent and construction support facilities for wind using the land use factor of 2.47 acres per MW presented in Section 7.2.2.5, the 8 acres per solar MW presented in Section 7.2.2.6 and the 455 acres for transmission connection.

Scenario	MW wind/number of 300 MW facilities	MW solar/number of 125 MW facilities	Disturbed Acreage (facilities and transmission)
70% wind 30% solar	1990/7	1410/12	24,700
50% wind 50% solar	1420/5	2350/19	33,100
30% wind 70% solar	851/3	3290/27	41,900

Just as for the discrete wind and solar alternatives, depending on the location of the facilities and transmission corridors, the land use disturbances could result in moderate to large impacts on wildlife habitats, vegetation, land use, and aesthetics. Therefore, a combination of wind and solar would not be a superior alternative to continued operation of PNPP. Beyond the land use and land disturbance related impacts to tens of thousands of acres, the site selection, land acquisition, certification by the Ohio Power Siting Board, permitting, and construction of each facility would require many months and challenge the need by date for a PNPP replacement of 2026. Compounding this sequential step process with 19 to 30 separate sites more than challenges this alternative, and thus, this alternative is not feasible from a practical standpoint either.

7.2.2.8 Hydropower

The U.S. Department of Energy's Oak Ridge National Laboratory assessed the ability of existing non-powered dams across the country to generate electricity. The non-powered dams in Ohio do not provide the scale of power generation capacity needed to replace PNPP's generation capacity having a cumulative total of less than 250 MW (ORNL 2012). The study assessed the dam with the greatest generation potential in Ohio to be approximately 14.6 MWe.

Construction of a new dam and hydropower facility would require significant siting considerations, such as the area that would be inundated to provide water storage for generation, as well as the overall environmental impacts associated with the development of the facility. The environmental impacts could be moderate or large for land use, water resources, socioeconomics, ecology, and cultural resources for a single location and replacement of the PNPP generation would require several locations to be developed.

The lack of potential for large hydroelectric power facilities at existing dams in Ohio and the environmental constraints associated with the development of a new hydropower facility make hydropower an unreasonable alternative to replace the PNPP generation.

7.2.2.9 Geothermal

The National Renewable Energy Laboratory graded the geothermal resources of the United States. Much of Ohio is graded as having the least potential for geothermal energy with the remainder having only one grade above the least potential (NREL 2018). Therefore, geothermal energy is not considered a reasonable power source for the replacement for PNPP.

7.2.2.10 Biomass

Biomass includes wood waste, municipal waste, manure, certain crops, and other types of waste residues used to create electricity. Using biomass-fired generation for baseload power depends on the geographic distribution, available quantities, constancy of supply, and energy content of biomass resources. Biomass, from wood and wood waste, landfill gas, and other feedstocks, accounts for the second-largest share of renewable electricity generation in Ohio. There are 17 utility-scale power plants fueled with biomass in Ohio. (EIA 2021b)

Biomass plants tend to be much smaller than nuclear or fossil fuel plants. To replace the PNPP baseload generation, it would take the construction of many biomass plants located near reliable fuel sources that continuously produce enough biomass to fuel the plants. Average size biomass plants are generally 50 MWe, with the largest ones being 120-140 MWe (BM 2022). Replacing the generating capacity of PNPP using only biomass would require the construction of nine or ten large facilities.

Biomass plants require storage facilities for the fuel products and for waste ash/residue for the wood, crop, and agriculture waste types. Wood waste plants require a large land area for storage and processing, and, like coal generation, they produce ash that must be disposed of in a manner that does not pollute waterways and air. Therefore, environmental impacts associated with construction of a wood waste plant could be moderate to large, with the impact intensity level being dependent on the siting and proximity to a source of wood waste.

Utilizing municipal solid waste for electricity is also dependent on being close to large population centers that generate large amounts of waste. Air emissions are also an issue with biomass plants, and construction of a plant would require installation of maximum achievable control technology to comply with the CAA. The combustion of the fuel also results in air emissions that must be controlled to meet air quality regulations.

Overall, the construction and operation of biomass plants of the size necessary to act as an alternative to PNPP would result in moderate to large environmental impacts to land use, water quality, ecological resources, and air quality and would not be a superior alternative to continued operation of PNPP.

Generating baseload generation from biomass sources is limited because of the need to site facilities near substantial fuel sources and impacts to land from constructing and operating the facility. In addition, without the construction of multiple smaller facilities, biomass plants are unable to produce the large baseloads of electricity that nuclear and fossil fuel plants generate. Therefore, biomass is not considered a reasonable alternative to PNPP's baseload generation.

7.2.2.11 Fuel Cells

Current fuel cell installations for large-scale stationary power are significantly smaller scale than what is needed as a reasonable replacement of PNPP's generating capacity with many of the systems installed for individual customers. Larger applications generally provide from hundreds of kW to tens of MWs of power (DOE 2017, DE 2019). As of January 2020, the United States had 550 MW of stationary fuel cell generation capacity (FCHEA 2020). Fuel cells as a utility-scale generation alternative are not presently competitive with other alternatives. Therefore, fuel cells are not considered a reasonable alternative to PNPP's baseload generation.

7.2.2.12 Ocean Wave and Current Energy

The Federal Energy Regulatory Commission has licensing authority over hydrokinetic energy projects deployed in the United States. Currently, there is only one licensed inland project, a project of 70 kW (FERC 2022).

Given hydrokinetic technology is in the early stages of commercial application and projects have low generation capacities, ocean wave and current energy is not considered a reasonable alternative in the necessary time frame for power supply.

7.2.2.13 Petroleum-fired

Oil-fired generation emits large amounts of carbon dioxide and hazardous air pollutants, making it undesirable for utilities looking to reduce air pollutants and comply with regulations. Based on the greater environmental impacts and cleaner energy source policies and regulations, oil-fired generation is not a reasonable alternative.

7.2.2.14 Coal-fired

Coal-fired plants are being retired throughout the United States to reduce carbon emissions and address concerns with ash storage and disposal. Energy Harbor's coal-fired plants, W. H. Sammis and Pleasants Power Station, produce a total of 2,790 MWe of reliable baseload generation and are slated for sale or closure in 2023 (EH 2022e). The NRC recently considered a supercritical pulverized coal facility as an alternative to renewing the River Bend Station Unit 1 OL but found license renewal as the preferred alternative. The supercritical pulverized coal facility alternative had operating impacts greater than license renewal, in addition to the environmental impacts inherent with new construction projects. (NRC 2018) Based on the greater potential environmental impacts, coal-fired generation is not a reasonable alternative.

7.2.3 Environmental Impacts of Alternatives

7.2.3.1 Natural Gas-Fired Generation

A natural gas-fired combined-cycle (NGCC) plant would consist of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator. Based on a capacity factor of 87 percent, the NGCC plant would have a design capacity of 1,350 MWe (gross) of generation to replace the current 1,175 MWe provided by PNPP (EIA 2021a). The NGCC plant would have a closed-cycle cooling system using new mechanical draft cooling towers (MDCTs) or the existing cooling towers.

7.2.3.1.1 Land Use

The PNPP site has available land for siting a replacement NGCC plant. Approximately 59 acres would be needed based on a (National Energy Technology Laboratory (NETL) factor of megawatt hour per square meter (m2/MWh) (NETL 2010a). Using an existing power plant site would also allow existing transmission infrastructure and corridors to be used with little to no additional land needed to support any needed additional lines or other infrastructure. Ohio has an abundance of natural gas transmission lines, particularly in the eastern half of the state including a natural gas transmission pipeline that traverses the PNPP site (USDOT 2022b). The proximity of existing pipelines would result in minimal extension of pipelines to supply the NGCC replacement plant. Further, given the existing natural gas supply in the United States, it is assumed that natural gas supply is adequate without the need for additional well development. As presented in Section 3.2.1, the PNPP site is zoned general industrial or heavy industrial, so siting the replacement NGCC plant there would not result in land use conversion. Minimal land use conversion for transmission lines and pipelines would have an overall SMALL land use impact.

7.2.3.1.2 Visual Resources

Use of an existing power plant would allow the additional structures to blend in with the existing ones during construction as well as operation. The tallest structures would be the exhaust stacks and some portion of these structures would likely be visible for 1 mile or more. The exhaust stack(s) would be lighted as required by Federal Aviation Administration requirements. In general, there would also be more lighting visible across the night landscape from the addition of the NGCC plant. At the PNPP site, the viewscape would still be dominated by the two existing parabolic cooling towers. Closed-cycle cooling would involve installation of MDCTs or reuse of the existing cooling towers. MDCTs are more similar in height to buildings rather than exhaust stacks and parabolic natural draft cooling towers. The additions to the viewscape would be similar in type and magnitude to the existing power plant and the impact to visual resources would be SMALL.

7.2.3.1.3 Air Quality

Temporary and minor effects on local ambient air quality could occur as a result of construction activities. Fugitive dust and fine particulate matter (PM) would be generated during earthmoving activities, material-handling activities, by wind erosion, and other activities, and managed in accordance with regulatory requirements and BMPs (e.g., paving or stabilizing disturbed areas, water suppression, reduced material handling) would minimize such emissions. Vehicles used to haul debris, equipment, and supplies, as well as equipment used for earthmoving, would create pollutants. All equipment would be serviced regularly, and all industrial activities would be conducted in accordance with federal, state, and local emission requirements. Emissions from construction activities would be temporary and intermittent for the duration of construction activities. With implementation of mitigation measures and properly serviced equipment impacts would be SMALL.

The operational NGCC plant would be equipped with air pollution controls to ensure compliance with air quality regulations. Emission estimates for the NGCC plant based on EPA AP-42 10 emission factors are shown in Table 7.2-1.

The NGCC plant would qualify as a new major source of criteria pollutants and would be subject to the CAA prevention of significant deterioration air quality review or the CAA nonattainment new source review. Therefore, the plant would have to comply with the new source performance standard for NGCC plants set forth in 40 CFR Part 60 Subpart KKKK and 40 CFR Part 60 Subpart TTTT. The plant would also qualify as a major source because of its potential to emit more than 100 tons per year of criteria pollutants. The plant would be required to obtain a Title V operating permit.

The NGCC plant would be subject to the national emission standards for hazardous air pollutants (HAPs) for stationary combustion turbines if the plant was a major source of HAPs, having the potential to emit 10 tons per year or more of any single HAP or 25 tons per year or more of any combination of HAPs [40 CFR 63.6085(b)]. A new NGCC plant would also have to comply with Title IV of CAA [42 USC 7651] reduction requirements for SO_2 and NO_x, which are the main precursors of acid rain and the major causes of reduced visibility.

Cooling towers would have air emissions and atmospheric effects from drift and plumes. Cooling tower drift consists of the liquid droplets entrained in the exhaust air stream. A plume forms when the saturated water vapor that leaves the top of the tower encounters cooler air and very small water droplets condense out of the air. Drift that leaves the top of the tower will reflect the same water chemistry as that of the circulating water. The water chemistry would be controlled and would be in accordance with any applicable limits and restrictions for use of water treatment chemicals and discharge limits.

When the small droplets within the drift or plumes are released into the air, evaporation occurs, leaving behind the solids that were once dissolved. This has the effect of introducing fine PM into the atmosphere. PM emissions (e.g., PM_{10} and $PM_{2.5}$) are regulated air emissions. The dissolved solids from both drift and plumes could also be deposited on the surrounding land. However, impacts on vegetation due to the deposition would be expected to be localized and primarily onsite. Atmospheric effects of plumes could include icing, fogging, and shadowing. The existing cooling tower at PNPP is located near cultivated fields, roadways, and Lake Erie, a commercial shipping waterway, features that could be impacted by icing, fogging, and shadowing, and dissolved solids deposition. PNPP was originally designed as a two-unit facility and NRC's Final Environment Statement considered the operation of two cooling towers (NRC 1982). In the Final Environmental Statement for PNPP Units 1 and 2, NRC determined the impacts of operation of both cooling towers to be small (NRC 1982). The NGCC's cooling tower(s) would have much less water flow than two operating nuclear units and the water chemistry would be controlled, so the impacts from plumes and drift are expected to be SMALL.

The impacts to local air quality during construction would be similar to any large-scale building project and would be conducted in compliance with applicable regulations and permits. Air quality impacts of construction would be SMALL. A new NGCC plant would be a major source of criteria pollutants and GHGs. Compliance with existing air quality regulations would ensure air quality impacts are minimized. Therefore, the operations-related impacts on air quality under the NGCC plant alternative would be MODERATE.

7.2.3.1.4 Noise

Sources of noise during construction would include clearing, earthmoving, foundation preparation, pile driving (if needed), concrete mixing and pouring, steel erection, and various stages of facility equipment fabrication, assembly, and installation. Additionally, a substantial number of diesel- and gasoline-powered vehicles and other equipment would be used. The size of the PNPP site would allow considerable sound level attenuation to offsite receptors. The sound level from most construction activities would be expected to be below the 60 to 65 dBA range of acceptable day-night average noise levels set by HUD at the site border. Construction activities resulting in offsite sound levels above this range would be temporary.

Noise impacts associated with plant operations would include noise from transformers, turbines, pumps, compressors, exhaust stack, combustion inlet filter house, condenser fans, the cooling towers, high-pressure steam piping, and loudspeakers. As stated above, the NGCC would be constructed at an existing power plant site and by such a location would have a setting where the noisy activity of an operational industrial site is acceptable. Further, the plant would operate in compliance with any applicable local noise ordinances. Construction and operations-related noise impacts would be SMALL.

7.2.3.1.5 Geology and Soils

Construction-related impacts to geology would be minimal as excavation would be shallow enough to not be expected to damage geologic formations. In addition, materials such as stone and gravel used in the construction would be sourced from local quarries and other local or regional sources. Therefore, construction-related impacts to geology would be SMALL.

Construction-related impacts to soil would occur during land clearing and filling and the construction of the plant. The exposure of soils during clearing and grubbing will increase the risk of erosion from precipitation and high wind events. Soils excavated and removed during clearing and construction would be stockpiled onsite for use as backfill after construction is completed. Because the ground disturbance would exceed one acre, Energy Harbor would obtain a stormwater construction permit from OEPA. This is a general permit for construction activities, OHC000005, that requires an erosion control and stormwater management plan and installation of BMPs to minimize erosion and sediment loss resulting from precipitation (OEPA 2018). Overall, with the installation and implementation of BMPs, construction-related impacts to soils would be SMALL.

Operations-related impacts on geology and soils from the NGCC plant would be minimized by adherence to the industrial stormwater permit governing the power plant site. The OEPA general industrial stormwater permit, OHR000006, requires a stormwater pollution prevention plan (OEPA 2017). Operations-related impacts would be SMALL.

7.2.3.1.6 Hydrology (Surface Water and Groundwater)

Surface Water

The construction-related impacts to surface water include those related to construction of the NGCC plant that would alter surface drainage features. The clearing of vegetation on the construction site may alter drainage features that convey runoff. The PNPP site is forest where enough acreage, approximately 59 acres, is available for the NGCC plant. The impacts from drainage alterations would be minimized by the implementation of BMPs identified in the stormwater general permit and erosion control and stormwater management plan. Adherence to the stormwater controls would minimize sediment release and provide protection to nearby waterbodies from accidental releases of oils or other chemicals being used.

Existing intake and discharge structures would be used if practical. If not, new, or modified structures would be constructed in or along the shoreline under a CWA Section 404 permit from the US Army Corps of Engineers, OEPA and other applicable state agencies.

Through compliance with permit conditions and implementation of BMPs, surface water impacts from NGCC plant construction would be SMALL.

Water needs for NGCC plant construction would be similar to typical uses of water for large industrial projects. These uses include dust abatement, concrete mixing, and potable water. In addition, construction could require minimal dewatering of excavations. Energy Harbor assumes water used for construction would be obtained through municipal supply. Groundwater and surface water use impacts from construction would be SMALL.

Operations-related water use would be primarily for cooling water makeup. Closed cycle cooling would result in water consumption due to evaporation and drift. The NGCC plant would have water withdrawals of approximately 4.86 MGD and consume approximately 4.21 MGD based on the water use factors developed by the National Energy Technology Laboratory of 0.15 gal/kilowatt hour (kWh) for withdrawals and 0.13 gal/kWh for consumption (NETL 2010b). As presented in Table 3.6-4a, PNPP's average makeup water withdrawal rate from 2017–2021 was 90.55 MGD.

A new NPDES permit or modifications to the existing permit would be required for the NGCC plant discharge. Adherence to the NPDES permit would minimize impacts to water quality.

Surface water use and quality impacts from operating renewable and natural gas combination alternative would be SMALL.

NGCC plant operations would require water for drinking, sanitary purposes, and likely for some processes. The supply would be from municipal supply. Groundwater quality impacts would be mitigated through use of BMPs and stormwater systems on the industrial site. In addition, waste management and spill mitigation would minimize the spread of contaminants through the soil into the groundwater. Therefore, operations-related impacts on groundwater use and quality would be SMALL.

7.2.3.1.7 Ecological Resources (Terrestrial and Aquatic)

Terrestrial

Terrestrial ecology impacts resulting from the construction of the NGCC plant would primarily result from land clearing, noise, and emissions of construction activities. The PNPP site is forest where enough acreage, approximately 59 acres, is available for the NGCC plant. The clearing of vegetation and tree removal would displace wildlife that occupies the industrial site, and these would disperse to nearby habitats.

Based on implementation of construction BMPs for erosion and dust control, noise abatement, proper equipment maintenance, adherence to tree removal requirements for protected species, and adherence to applicable permit conditions, the overall impact of construction-related activities on terrestrial ecological resources would be SMALL.

Operational impacts on terrestrial resources would be similar to those occurring with the operation of PNPP. With the impacts to terrestrial ecology being nearly all attributable to land clearing and habitat removal during construction, the impacts attributable to operations would be SMALL.

Aquatic

Impacts on aquatic resources during construction would be minimal through implementation of BMPs, which would minimize impacts from surface water discharges and shoreline construction needed to constructure new or modify existing intake and discharge structures. Construction for the intake and discharge structure could require dredging which would require a CWA Section 404 permit from the US Army Corps of Engineers OEPA and other applicable state agencies. Permit conditions would address measures to reduce impacts to water quality and aquatic resources.

Implementation of the SWPPP in place at PNPP and BMPs in the construction stormwater permit would also minimize potential spills and releases associated with the construction of the plant. Therefore, construction-related impacts on aquatic ecological resources would be SMALL.

During operations, the NGCC plant would require less cooling water intake than PNPP. The NGCC plant would also require an NPDES permit. Operations-related impacts on aquatic ecological resources would be SMALL.

Special Status Species

The NGCC plant would not require a federal permit except for construction in or along a waterway or in wetlands, so the federal action for review of the potential for impacts to protected species would be limited. However, Ohio Code Chapter 4906 does require a certificate issued by the Ohio Power Siting Board (OPSB) prior to development of generation facilities in Ohio.

The certificate application requires a field survey for vegetative communities and wetland delineation as well as a literature survey for special status species. The OPSB would consider impacts to special status species in their review of whether to grant a certification or not for the project.

Construction at the PNPP site would require tree removal and USFWS guidance regarding nesting and roosting trees would be followed. Tree removal would require adherence to practices that avoid take of the northern long-eared bat and the bald eagle, or if take cannot be avoided, take permits for one or both of the species would be required. To protect the northern long-eared bat, the USFWS 4(d) Rule restricts tree removal within 0.25 mile of a known hibernaculum and within a 150-foot radius of a known occupied maternity roost tree during June and July (USFWS 2019a). To avoid take of the bald eagle, timber harvesting operations would avoid clear-cutting within 330 feet of active or inactive nests at any time and avoid encroaching within 660 feet of an active nest during nesting season (USFWS 2019b).

For construction in or along waterways such as the construction of new or modified intake and discharge structure or for dredging, a CWA Section 404 permit would be required. The application would require information on protected aquatic species and the potential for impacts from the project. The permit conditions would require measures to minimize impacts to protected species. Use of a closed cycle cooling system and compliance with a state issued NPDES permit would minimize impacts to aquatic species from impingement and entrainment and impacts to water quality during operations.

If take of a federally protected species is anticipated, a take permit would be required. The USFWS would issue a take permit after it has ensured a variety of safeguards and determined that authorizing the activity will not jeopardize the continued existence of the species or destroy its habitat. A Habitat Conservation Plan must accompany the take permit application. As presented in Section 3.7.8, suitable habitat exists onsite particularly in the wooded areas; however, no federal listed species have recorded occurrences within a 1-mile radius of the PNPP site. Thus, construction and operation of a NGCC plant at the PNPP site MAY AFFECT but is NOT LIKELY to ADVERSELY AFFECT federally listed species.

As discussed in Section 3.7.8, the PNPP has suitable habitat for various state listed species. The field survey required by the OPSB would provide additional information on the terrestrial habitat to indicate the potential for presence of special status species. Overall, the construction and operation of a NGCC plant at the PNPP site would have a SMALL to MODERATE impact on special status species.

7.2.3.1.8 Historic and Cultural Resources

For the PNPP site, the forested areas outside the developed area would be where a NGCC construction footprint would be selected. As mentioned in Section 3.8.5, only 160 acres of the approximately 1,030-acre PNPP site were surveyed prior to construction, so the potential exists for impact to cultural sites. Section 4.7.4.2 also described the 6-mile radius of the site as archaeologically sensitive. Ohio does not require the protection of cultural resources on private lands and no federal permit would be required for upland construction activities for the NGCC. Prior to issuing a certificate for a new generating facility, the OPSB would consider impacts to registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significance within ten miles of the project area. Landmarks to be considered are those districts, sites, buildings, structures, and objects that are recognized by, registered with, or identified as eligible for registration by the national registry of natural landmarks, the state historical preservation office, or the Ohio department of natural resources. This OPSB rule would protect some cultural sites but not all. However, the NGCC plant located on an existing power plant site would be unlikely to significantly increase any impacts to offsite cultural sites. Depending on the NGCC construction footprint within the PNPP site, cultural resources could be NO EFFECT or impacts could be ADVERSE EFFECT.

7.2.3.1.9 Socioeconomics

Socioeconomic Issues other than Transportation

The project timeline of planning, procurement, and construction duration would be 2-3 years. The peak construction workforce would be about 1,200 and would likely be primarily from the surrounding area rather than relocation (NRC 2019). Construction would have beneficial economic impacts in the area by creating direct and indirect jobs and incomes, increasing purchases of goods and services, and generating tax revenues. The workforce would also result in additional pressure on local temporary housing, community services, and infrastructure. Given the peak workforce size and duration of the project, both the beneficial and adverse socioeconomic impacts would likely be SMALL for Lake County.

The operations workforce for a NGCC plant located at the PNPP site would be 150 workers (NRC 2019) and would provide beneficial SMALL long-term socioeconomic impacts to Lake County.

Transportation

The temporary construction workforce at its peak would likely be noticeable and could cause congestion on roadways in the proximity of the construction site. To reduce congestion, staggered work shifts for construction could be implemented. The much smaller operations workforce would not have these congestion impacts and would be assigned to work shifts. The socioeconomic impacts of the NGCC alternative would be SMALL to MODERATE for construction and SMALL for operations.

7.2.3.1.10 Human Health

Impacts on human health from construction of an NGCC plant would be similar to those associated with a large industrial facility construction project. Worker safety would be addressed by following the OSHA worker protection standards. The radiological human health impact on construction and operations workers due to working in proximity to operating and then decommissioning PNPP would be SMALL due to compliance with NRC regulations and adherence to ALARA principles. Operation of an NGCC plant would also have similar impacts to the existing power plant and would be in compliance with OSHA standards.

Human health impacts from the operation of the NGCC plant would primarily be from air pollutant emissions. The NGCC plant would emit criteria air pollutants (Table 7.2-1). Some pollutants, such as NO_x, contribute to ozone formation, which can create health problems. These criteria pollutants are regulated, and technology will be installed in the plant to limit the criteria air pollutant releases.

Overall, with application of pollutant controls and compliance with air quality standards and compliance with OSHA worker safety standards, operations-related impacts to human health under the NGCC alternative would be SMALL to MODERATE.

7.2.3.1.11 Environmental Justice

Potential impacts from construction of an NGCC plant would primarily be associated with socioeconomic effects. These impacts would consist of the short-term beneficial impacts from an increase in worker expenditures at local businesses and short-term adverse impacts from rental housing shortages and traffic congestion during the construction phase of the project. Environmental and socioeconomic impacts would be minor and would not be expected to result in disproportionately high and adverse effects to low income and minority communities.

The activities associated with the operating plant would be similar to those at PNPP with the exception being air emissions if the NGCC was sited at PNPP. As presented in Section 7.2.3.1.3, air quality impacts from a NGCC plant would be MODERATE. Section 3.11.2 presents the minority and low-income population in the region surrounding the PNPP site. The closest identified minority population is adjacent to the western side of the site (Figure 3.11-4). The closest low-income block group that meets the guidance criteria for individuals or families is located 6 miles southwest of the PNPP center point. Minority populations living in close proximity to the NGCC power generating facility could be disproportionately affected by emissions associated with plant operations. However, because emissions are expected to remain within regulatory standards, impacts from emissions are not expected to be high and adverse. No disproportionately high and adverse effects would be expected for minority or low-income communities.

7.2.3.1.12 Waste Management

Solid, liquid, and gaseous waste generated during the construction of the NGCC plant would be handled according to county, state, and federal regulations, and disposed of at permitted offsite treatment or disposal facilities. Therefore, construction-related waste impacts would be SMALL.

Operation of the NGCC plant would result in waste from spent catalytic reduction catalysts used to control nitrous oxide emissions. This waste stream is considered hazardous and would be disposed of at a facility that handles hazardous materials. Other waste generated at the site would be characterized as hazardous or nonhazardous. The nonhazardous and hazardous waste would be managed in compliance with state regulations and disposed of in permitted facilities. Energy Harbor would implement recycling and waste minimization programs that would reduce waste volumes. The non-radiological waste impacts from operations would be SMALL given Energy Harbor's compliance with regulations, use of permitted facilities, and implementation of effective practices for waste minimization.

7.2.3.2 Renewable and Natural Gas Combination Alternative

The renewable and natural gas combination alternative relies on renewables for approximately one-third of the generation with the remaining generation coming from natural gas. Renewables in current use by utilities (wind, solar, hydropower, biomass) require vast amounts of land for generation or fuel sources (Section 7.2.2). To replace the 1,175 MWs provided by PNPP with just renewables would require acreages far beyond that of a natural gas alternative and for that resource area alone would not be a reasonable comparative alternative to the proposed action to support NEPA decision-making. Including natural gas generation in the combination minimizes land use conversion because (1) the plant can be located at the PNPP site, (2) existing natural gas pipeline traverses the PNPP site, so no land conversion for pipelines is needed, and (3) the abundant natural gas supply in the United States eliminates the need for more acreage to be converted for new natural gas wells. Continuing to use the PNPP site for natural gas-fired generation continues to provide tax revenue and employment for Lake County. Further, natural gas is a cleaner burning fuel than biomass fuels and would operate under strict emission regulations. The balanced renewable and natural gas combination alternative includes an NGCC plant at the PNPP site, solar PV installations, and onshore wind installations as follows:

- 830 MW (net) NGCC plant at PNPP site.
- Six approximately 125 MW solar installations located offsite in Ohio with battery storage to make it baseload.
- 540 MW wind installation in Ohio.

To yield approximately 830 MWe net, the size of the NGCC plant component would be 878 MWe (gross) based on an EIA capacity factor of 0.87 (EIA 2021a). Solar generation has a much lower capacity factor to account for nighttime hours and daytime hours with varying solar irradiation. Each installed solar MW would yield approximately 2,190 MWh of generation annually using a 25 percent capacity factor. The six 125 MW installations would be supported with onsite lithium-ion battery storage to provide firm generation. Accumulatively, the six solar installations would provide approximately 15 percent of PNPP's net generation. Each of the six installations are assumed to be located in Ohio. The installations are assumed to require new transmission lines and corridors to connect to the regional grid. Wind generation in 2014-2019 has an average generation capacity of 41.4 percent (DOE 2021). Using this capacity factor, 1 MW installed wind generation would provide approximately 3,627 MWh of generation annually. The 540 MW installed wind generation would provide approximately 20 percent of PNPP's net generation. This amount of installed wind would require multiple wind farms, each with a transmission connection to the regional grid. Energy Harbor assumed that the 540 MW of wind would be installed in six wind farms located in Ohio.

7.2.3.2.1 Land Use

The NGCC component of the renewable and natural gas combination alternative is 65 percent the size of the NGCC discrete alternative. The renewable and natural gas combination alternative NGCC plant would be sited within the same construction footprint as the discrete NGCC alternative, requiring less overall acreage. However, as presented in Section 3.2.1, the PNPP site is zoned general industrial or heavy industrial, so siting the replacement NGCC plant there would not result in land use conversion. The plant would require clearing of a smaller acreage, reducing the impact of terrestrial habitat removal. Therefore, the land use impacts for the NGCC plant component would be bounded that of the NGCC alternative described in Section 7.2.3.1.1 and would be SMALL for construction and operation.

As discussed in Section 7.2.2.1.5 and 7.2.2.1.6, solar and wind facilities require large areas of land to generate electricity. Using 8 acres per MW would require 1,000 acres for each solar installation, a total of approximately 6,000 acres. As presented in Section 7.2.2.1.5, wind installation land requirements have three metrics: farm boundary, construction footprint, and permanent structures. The wind component of the renewable and natural gas combination alternative would require 46,100 acres for wind farms, approximately 1,330 acres disturbed for construction, and approximately 400 acres occupied by permanent structures. The solar acreage would require land use conversion for electricity generation. The wind turbines can be co-located with compatible land uses, so at a minimum the permanent structure acreage would require land use conversion.

Energy Harbor assumes 25 miles of new 345-kV transmission lines in a new 150-foot-wide ROW transmission corridor would need to be developed to support each solar and wind installation, an acreage requirement of 455 acres each or approximately 4,090 acres total for the six solar and three wind installations. The new transmission corridors would require land conversion.

Given that Energy Harbor would screen the sites and selected sites would be compatible with existing county-level or planning region land use plans, the impact of individual sites would not be expected to have a significant impact. However, the total acreage needed to support the offsite installations and the acreage required for transmission would impact many landowners including adjacent residences, overall, the project would have a MODERATE to LARGE land use impact.

7.2.3.2.2 Visual Resources

Visual impacts from the NGCC plant component of the renewable and natural gas combination alternative would be essentially the same as those described for the discrete NGCC alternative in Section 7.2.3.1.2.

The solar installations would require large land areas. The solar panels could be visible to the public from offsite locations, depending on buffer areas or screening. The solar installations would be sited to comply with land zoning and any required buffers or screening.

The wind turbines of each wind installation would be visible from all directions and could be a large impact on the viewshed depending on the site selected. In addition, the rotating blades of wind turbines cast moving shadows on the ground and on structures, causing the phenomenon of shadow flicker. Shadow flicker is considered a nuisance rather than a human health hazard and the potential impact of shadow flicker can be mitigated by setback distances from structures, vegetative buffers, or the curtailment of the turbine during times of highest impact (DOE 2015).

Site selection would seek to minimize visual impacts and would avoid impacting scenic areas such as U.S. Congress-designated areas for protection of unique natural, cultural, and recreational values (e.g., national scenic and historic trails, national historic landmarks, scenic areas, recreation areas, preserves, and monuments). Avoiding impacts on the most scenic viewsheds would reduce the most significant visual impacts, allowing the impact to be noticeable but not destabilizing.

The turbines would be marked and lighted according to Federal Aviation Administration (FAA) guidelines, which call for painting the turbines and towers white or light gray, while making them highly visible to pilots from the air. Aviation red flashing, strobe, or pulsed obstruction lights would be mounted atop selected turbines and at the end of each turbine string or within and around the perimeter such that the gap between lights is no greater than 0.5 miles, allowing the entire facility to be perceived as a single unit by pilots flying at night. The specific location of aviation lighting and the operation of the lighting system would be determined in consultation with FAA. (FAA 2018)

The visible impact of the transmission lines for the solar and wind installations would not appear any different than existing transmission lines. Site selection would avoid scenic views and impacts to cultural resources. Mitigation measures to reduce impacts of shadow flicker would be implemented as appropriate. Overall, the visual impacts from the construction and operation of the renewable and natural gas combination alternative would range from SMALL to MODERATE.

7.2.3.2.3 Air Quality

The impacts on air quality due to construction and operation of the NGCC plant would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3 and would be SMALL for construction related impacts and MODERATE for operational impacts. The estimated criteria air pollutant and carbon dioxide emissions are presented in Table 7.2-1.

Construction activities associated with the solar and wind installations would generate fugitive dust. Mitigation would be implemented via wetting of cleared areas and dirt roads to minimize the fugitive dust. Construction equipment and vehicles would also emit exhaust emissions.

These emissions would be temporary and mitigation such as curtailing idling of vehicles would be implemented to minimize short-term air quality impacts. Construction emissions associated with the solar and wind components of the renewable and natural gas combination alternative would be SMALL. The solar and wind components of the renewable and natural gas combination alternative would not release air emissions during operation.

Overall, the air quality impacts from the construction of the renewable and natural gas combination alternative would be SMALL, and operations would be MODERATE for the NGCC component.

7.2.3.2.4 Noise

The construction and operation of the NGCC plant component of the renewable and natural gas combination alternative would have noise impacts similar to those described in the discrete NGCC plant alternative presented in Section 7.2.3.1.4 and would be SMALL.

Construction of each solar and wind installation would likewise have noise impacts similar to those described in the discrete NGCC plant alternative presented in Section 7.2.3.1.4 with a shorter duration. However, given the acreage of the solar installations and the potential need for land clearing and the number of turbines that would need to be installed, noise impacts would range from SMALL to MODERATE and be temporary for the duration of construction of each facility.

No noise impacts would occur from operation of a solar installation. During operations, the wind turbines would emit sound. Turbine sound is typically one of the greatest nuisance impacts associated with wind power. The USDOE addressed this concern with a review of the available data and research on impacts to human health, concluding that as of 2013, global peer-reviewed scientific data and independent studies consistently concluded that sound from wind plants has no direct impact on physical human health. (DOE 2015)

Overall, construction-related noise impacts associated with renewable and natural gas combination alternative is dependent on the site selected and proximity to residents and other sensitive receptors and would range from SMALL to MODERATE. Operations-related noise impacts associated with the renewable and natural gas combination alternative would be SMALL.

7.2.3.2.5 Geology and Soils

The impact on geology and soils due to construction and operation of the NGCC component of the renewable and natural gas combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.5 and would be SMALL.

Construction impacts to geology and soils resulting from the construction of the solar and wind installations and supporting transmission lines would primarily be impacts to soils from clearing and grubbing. These temporary soil impacts would be minimized by implementation of BMPs. Geological impacts would be minor, as any gravel or stone used in the construction of roads and infrastructure would be sourced from local businesses that sell materials sourced from local quarries. During operations, the solar and wind installations would be required to have a NPDES construction stormwater permit and comply with OEPA regulations to control stormwater runoff.

Overall, the geology and soil impacts from the construction and operation of the renewable and natural gas combination alternative would be SMALL.

7.2.3.2.6 Hydrology (Surface Water and Groundwater)

The impact on surface water and groundwater use and quality due to constructing and operating the NGCC plant component would be similar to that associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.6 and would be SMALL for construction and for operation.

Construction of the solar and wind installations and their supporting transmission lines would require water for dust suppression, equipment washing, and sanitary systems. The solar and wind installation would not have process water needs for operation, but water would be needed for periodically washing the solar panels. The water demand could be meet by municipal supply available at the site, trucked in portable water, or onsite or nearby surface or groundwater resources. Energy Harbor would utilize the most practical supply and comply with any required water withdrawal permits and applicable regulations. Water quality impacts could result from erosion and runoff associated with the construction of the solar and wind installations. These temporary soil impacts would be minimized by implementation of BMPs and compliance with stormwater permits and applicable regulations. Groundwater would be protected through the implementation of stormwater controls and spill prevention measures. Once in operation, Energy Harbor would operate the installations in compliance with stormwater regulations. The use and water quality impacts for both surface water and groundwater resources associated with the construction and operation of the solar and wind installations would be SMALL.

Overall, the impacts to surface water resources from the construction and operation of the renewable and natural gas combination alternative would be SMALL. Overall, the impacts to groundwater resources for the renewable and natural gas combination alternative would be SMALL.

7.2.3.2.7 Ecological Resources (Terrestrial and Aquatic)

Terrestrial

As with the discrete NGCC plant alternative, the NGCC plant component of the renewable and natural gas combination alternative would be constructed onsite and would require clearing of some of the forested area onsite. The impact on terrestrial resources due to construction and operation of the NGCC plant component of the renewable and natural gas combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.7 and would be SMALL for construction and operations.

Terrestrial ecology impacts from the construction of solar and wind installations and new transmission corridors would result from clearing approximately 11,400 acres of land much of which is likely to be providing terrestrial habitat. Siting considerations for the OPSB would suggest avoidance of wetlands and other high-quality terrestrial habitats such as critical habitat for threatened and endangered species and habitats identified as a priority for preservation. Energy Harbor would also follow USFWS guidance for land-based wind energy development and eagle conservation (USFWS 2012; USFWS 2013). The guidance focuses on "species of concern" and addresses loss and degradation/fragmentation of habitat. Therefore, terrestrial ecology impacts associated with the solar and wind components of the renewable and natural gas combination alternative would be SMALL to MODERATE given the large land requirement.

No operational impacts to terrestrial ecological resources would occur from the solar component of the renewable and natural gas combination alternative. The operation of the wind turbines could affect avian and bat species. Following USFWS guidance for siting would minimize impacts and compliance with any incidental take permits would minimize impacts to special status species. Mortality rates for birds at land-based wind plants average between three and five birds per MW per year, and no plant has reported an average greater than 14 birds per MW per year, with common songbirds accounting for approximately 60 percent of all bird collision mortality (DOE 2015). Those mortality levels for the 61 gigawatt of wind capacity installed in 2013 at the time of USDOE's study constitute a very small percentage, typically <0.02 percent, of the total populations of those songbird species. (DOE 2015) Using the annual average of five bird deaths per MW, operation of the wind component of the renewable and natural gas combination alternative would result in an estimated 2,700 bird deaths per year of operation.

Overall, the ecological impacts to terrestrial species from construction and operation of this alternative would be MODERATE to LARGE primarily due to the acreage disturbed and permanent terrestrial habitat removal.

Aquatic

The NGCC component would use the same cooling water intake and discharge configuration as the discrete NGCC alternative. The renewable and natural gas combination alternative NGCC plant would be about 65 percent the size of the discrete alternative and therefore use less cooling water. The impact on aquatic resources due to constructing and operating the NGCC plant component of the renewable and natural gas combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.7.

No impacts to aquatic resources would result from the construction of the solar and wind components of the renewable and natural gas combination alternative due to the implementation of BMPs to control erosion and run-off. No operations-related impacts are associated with the solar and wind components of the renewable and natural gas combination alternative.

Therefore, the ecological impacts to aquatic species from the construction and operation of the renewable and natural gas combination alternative would be SMALL.

Special Status Species

The NGCC plant component of the renewable and natural gas combination alternative would be constructed within the same area as the discrete NGCC alternative, requiring clearing of terrestrial habitat that is suitable for federally and state listed species. As presented in Section 3.7.8, no federal listed species have recorded occurrences within a 1-mile radius of the PNPP site. Construction and operation of a NGCC plant at the PNPP site MAY AFFECT but is NOT LIKELY to ADVERSELY AFFECT federally listed species.

Siting considerations for the OPSB suggests avoidance of wetlands and other high-quality terrestrial habitats such as critical habitat for threatened and endangered species and habitats identified as a priority for preservation. Energy Harbor would also follow USFWS guidance for land-based wind energy development and eagle conservation (USFWS 2012; USFWS 2013). The guidance focuses on "species of concern" and addresses loss and degradation/fragmentation of habitat. Given avoidance, minimization, and mitigation measures, and compliance with applicable permits, each solar and wind installation MAY AFFECT, but is NOT LIKELY to ADVERSELY AFFECT federally listed species.

Overall, given the acreage needed for the solar and wind installations, with the required certificate from the OPSB needed, construction of the renewable and natural gas combination alternative would have a MODERATE impact and operation would have a SMALL to MODERATE impact on special status species.

7.2.3.2.8 Historic and Cultural Resources

The impact on historic and cultural resources due to constructing the NGCC plant component of the renewable and natural gas combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.8 and would be NO EFFECT or impacts could be ADVERSE EFFECT.

Development of solar and wind installations and supporting transmission lines could impact cultural resources, depending on the siting location. Impacts to historic and cultural resources could range from NO EFFECT to ADVERSE EFFECT, depending on the site.

7.2.3.2.9 Socioeconomics

Socioeconomic Issues Other than Transportation

The construction and operation of the NGCC component of renewable and natural gas combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.9 and the beneficial and adverse socioeconomic impacts would likely be SMALL for Lake County.

The construction and operation of the solar and wind components and supporting transmission lines of the renewable and natural gas combination alternative would create fewer construction jobs than the NGCC plant. Any boost to the local economies would be short in duration, and socioeconomic impacts related to the construction of renewable and natural gas combination alternative would be SMALL.

The number of workers required to maintain each solar and wind installation would be small, and it would not result in a quantifiable impact on the local economy. If Energy Harbor leased the property for the solar and wind installations, lease payments would be made to the property owners. The solar installations and the property occupied by the wind turbines could be taxed at a higher rate than agricultural land, providing a tax benefit. The beneficial impact would be dependent on the tax base of the county, but the impact would likely be small. Therefore, the operations-related socioeconomic impacts under the solar and wind components of renewable and natural gas combination alternative would be SMALL.

Overall, the socioeconomic impacts from the construction and operation of the renewable and natural gas combination alternative would be SMALL for all counties.

Transportation

Transportation impacts during the construction and operation of the NGCC plant would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.9 and would be SMALL to MODERATE during construction and SMALL during operation.

The construction workforce and equipment transported to the individual solar and wind sites would be less than that for the NGCC plant. Traffic impacts associated with the operation of each solar and wind facility would not be quantifiable. Once the facility is in operation, very few employees would be required for facility operations. Therefore, transportation impacts for construction and operation under the solar and wind components of the renewable and natural gas combination alternative would be SMALL.

Overall, the transportation impacts associated with construction of the renewable and natural gas combination alternative would be SMALL for the solar and wind components and range from SMALL to MODERATE for the NGCC component. The impacts during operation would be expected to be SMALL for all the components of the renewable and natural gas combination alternative.

7.2.3.2.10 Human Health

Impacts on human health from construction and operation of the NGCC component of the renewable and natural gas combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.10 and would be SMALL for construction and SMALL to MODERATE for operations.

During construction of the solar and wind installations, worker safety would be addressed by following the OSHA worker protection standards. Therefore, construction-related impacts on human health under the solar and wind components of the renewable and natural gas combination alternative would be SMALL. As mentioned in Section 7.2.3.2.4, regarding wind turbine noise, the USDOE concluded that sound from wind plants has no direct impact on physical human health. (DOE 2015)

Therefore, the human health impacts associated with the construction of the renewable and natural gas combination alternative would be SMALL and range from SMALL to MODERATE for operations.

7.2.3.2.11 Environmental Justice

Potential impacts on minority and low-income populations from construction and operation of the NGCC component of the renewable and natural gas combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.11.

Potential impacts on minority and low-income populations from the construction of solar and wind components of the renewable and natural gas combination alternative would primarily result from socioeconomic effects. Some minor environmental impacts would result during construction from fugitive dust, but this impact would be temporary and short in duration. Socioeconomic impacts on minority and low-income population under the renewable and natural gas combination alternative would consist of the short-term increase in worker expenditures at local businesses and potential rental housing shortages during the construction phase of the projects. The temporary increase in traffic on roads would likely result in some small impacts to traffic that could affect local minority and low-income populations.

The construction and operation of the solar and wind components of the renewable and natural gas combination alternative would be unlikely to have disproportionately high and adverse human health and environmental effects on minority and low-income populations due to the temporary nature of construction impacts. The NGCC plant sited at the PNPP site in close proximity to a minority population would have air emissions that could have air quality and health impacts. However, because emissions are expected to remain within regulatory standards, impacts from emissions are not expected to be high and adverse. Overall, the renewable and natural gas combination alternative is expected to have no disproportionately high and adverse human health and environmental effects on minority and low-income populations.

7.2.3.2.12 Waste Management

Impacts on waste management from construction and operation of the NGCC component of the renewable and natural gas combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.12 and would be SMALL.

The construction of the solar and wind installations would create land clearing waste disposed of onsite or shipped to an offsite construction debris landfill. The construction of the solar and wind installations would create sanitary and industrial waste in smaller quantities than the NGCC plant. This waste would be recycled, disposed of onsite, or shipped to an offsite waste disposal facility. The operation of each solar and wind installation is expected to generate very minimal waste from daily operations. The battery storage system at each solar installation would have to be replaced after several years of operation; however, much of the components are recyclable, minimizing the waste generation. Solar developers are currently assuming lifespans for solar panels to be 30 years or more (LBNL 2020). Wind turbine manufacturers are generally indicating that current designs have a 30-year lifespan (LBNL 2019). There would be significant waste generation upon decommissioning as there would be for decommissioning of a nuclear power plant. As a good environmental steward, Energy Harbor would implement waste management practices to recycle or dispose of at an offsite waste disposal facility all waste generated at the installations. Therefore, waste management impacts from daily operations of the solar and wind installations would be SMALL.

Overall, the waste management impacts from the construction and operation of the renewable and natural gas combination alternative would be SMALL.

Table 7.2-1 Air Emissions Estimated for NGCC and Renewable and Natural Gas Combination Alternatives

Emission	NGCC Alternative (1,350 MWs) (estimated tons/year)[b]	Renewable and Natural Gas Combination Alternative NGCC plant (878 MWs) (estimated tons/year)[b]
Sulfur dioxide	123	80
Nitrogen oxides[a]	470	306
Carbon monoxide	1,086	706
Particulate matter 10 microns	239	155
Nitrous oxide	109	71
Volatile organic compounds	76	49
Carbon dioxide	3,981,133	2,587,737

a. Assumes 90 percent reduction in emissions due to operation of air pollution control equipment (selective catalytic reduction).

b. Estimates based on EPA AP-42 emission factors. See formulas below.

Formulas and Sources

Annual gas consumption (ft^3)	Plant size in MWe x heat rate x 1,000 x (1/ heat content) x hours in a year						
Heat rate = 6,119 Btu/kWh (FPL 2020) Heat content of natural gas 2020 = 1,033 Btu/ft^3 (EIA 2021c)							
Annual MMBtu = (annual gas consumption x heat content)/1,000,000							
Emission factor for processed natural gas (lbs/MMBtu)	CO_2	NO_X	CO	PM	SO_2	VOC	N_2O
	110	0.13	0.03	0.0066	0.0034	.0.0021	0.003
Annual emissions (tons) = (emission factor) x (annual MMBtu)/2000							
Air emission factors (EPA 2000)							

7.3 Alternatives for Reducing Adverse Impacts

7.3.1 Alternatives Considered

As noted in 10 CFR51.53(c)(3)(iii), "The report must contain a consideration of alternatives for reducing adverse impacts, as required by 51.45(c), for all Category 2 license renewal issues in Appendix B to Subpart A of this part." A review of the environmental impacts associated with the Category 2 issues in Chapter 4 identified no significant adverse effects that would require consideration of additional alternatives. Therefore, Energy Harbor concludes that the impacts associated with renewal of the PNPP OL would not require consideration of alternatives for reducing adverse impacts as specified in NRC Regulatory Guide 4.2, Revision 1 (NRC 2013b). This determination assumes the existing mitigation measures discussed in Section 6.2 adequately minimize and avoid environmental impacts associated with operating PNPP.

7.3.2 Environmental Impacts of Alternatives for Reducing Adverse Impacts

No additional alternatives were considered by Energy Harbor to reduce impacts because as determined in Chapter 4, the continued operation of PNPP does not result in significant adverse effects to the environment.

8.0 COMPARISON OF THE ENVIRONMENTAL IMPACT OF LICENSE RENEWAL WITH THE ALTERNATIVES

To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form . . . . [10 CFR 51.45(b)(3)]

The proposed action is renewal of the PNPP Unit 1 OL, which would preserve the option to continue to operate PNPP to provide reliable baseload power and meet future generating demand throughout the proposed 20-year LR operating term. Chapter 4 provides analyses of the environmental impacts for the proposed action. The proposed action is compared to the no-action alternative, which includes both the termination of operations and decommissioning of PNPP and reasonably foreseeable replacement of its baseload generating capacity. The termination of operations and decommissioning impacts are presented in the GEIS, Section 14.2.2, and decommissioning impacts are analyzed in the GEIS on decommissioning, NUREG-0586, Supplement 1 (NRC 2002; NRC 2013a). The energy alternatives component of the no-action alternative is described, and its impacts analyzed in Chapter 7.

Table 8.0-1 summarizes the environmental impacts of the proposed action and the alternatives deemed reasonable for comparison purposes. Tables 8.0-2 and 8.0-3 provide a more detailed comparison. The environmental impacts compared in Tables 8.0-1, 8.0-2, and 8.0-3 are Category 1 and 2 issues that apply to the proposed action or issues that the GEIS identified as major considerations in an alternatives analysis.

In conclusion, there is no reasonable alternative that is environmentally preferable to the continued operation of PNPP. All alternatives capable of meeting the needs currently served by PNPP entail impacts greater than or equal to the proposed action of PNPP LR. The continued operation of PNPP would create significantly less environmental impact than the construction and operation of new alternative generating capacity. In addition, the continued operation of PNPP will have a superior positive economic impact on Lake County through tax revenues paid by Energy Harbor for PNPP. Continued employment of plant workers will continue to provide economic benefits to the surrounding communities.

Table 8.0-1 Environmental Impacts Comparison Summary (Sheet 1 of 2)

Impact Area[a]	Proposed Action	No-Action Alternative		
		Termination of Operations and Decommissioning	NGCC Plant	Combination
Land Use	SMALL	SMALL	SMALL	MODERATE to LARGE
Visual Resources	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL (construction) MODERATE (operations)	SMALL (construction) MODERATE (operations)
Noise	SMALL	SMALL	SMALL	SMALL to MODERATE (construction) SMALL (operations)
Geology and Soils	SMALL	SMALL	SMALL	SMALL
Surface Water	SMALL	SMALL	SMALL	SMALL
Groundwater	SMALL	SMALL	SMALL	SMALL
Terrestrial	SMALL	SMALL	SMALL	SMALL to MODERATE
Aquatic	SMALL	SMALL	SMALL	SMALL
Special Status Species	MAY AFFECT, NOT LIKELY to ADVERSELY AFFECT (piping plover, red knot, and monarch butterfly); NO EFFECT (other species)	[b]	MAY AFFECT, NOT LIKELY to ADVERSELY AFFECT	MAY AFFECT, NOT LIKELY to ADVERSELY AFFECT
Historic and Cultural	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO EFFECT to ADVERSE EFFECT	NO EFFECT to ADVERSE EFFECT

Table 8.0-1 Environmental Impacts Comparison Summary (Sheet 2 of 2)

Impact Area[a]	Proposed Action	No-Action Alternative		
		Termination of Operations and Decommissioning	NGCC Plant	Combination
Socioeconomics	SMALL	SMALL to MODERATE (termination) SMALL (decommissioning)	SMALL adverse and SMALL beneficial for Lake County	SMALL adverse and SMALL beneficial for host counties
Transportation	SMALL	SMALL	SMALL to MODERATE (construction) SMALL (operations)	SMALL to MODERATE (construction) SMALL (operations)
Human Health	SMALL	SMALL	SMALL (construction) SMALL to MODERATE (operations)	SMALL (construction) SMALL to MODERATE (operations)
Environmental Justice	No disproportionately high and adverse effects	[b]	No disproportionately high and adverse effects	No disproportionately high and adverse effects
Waste Management	SMALL	SMALL	SMALL	SMALL

a. As defined in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3:
SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

b. NUREG-0586 Supplement 1 (NRC 2002), the decommissioning GEIS, identifies this resource area as requiring a site-specific analysis based on site conditions at the time of decommissioning, as well as the proposed decommissioning method and activities. Decommissioning PNPP would at a minimum occur after the expiration of the current license term. The magnitude of impacts could vary widely based on site-specific conditions at the time and analysis of special status species and/or their habitat(s), a consideration of their presence or their habitats' presence, and an environmental justice analysis of the potential for disproportionately high and adverse impacts from the impacts of decommissioning being experienced by minority or low-income populations as determined by the most recent USCB decennial census data when the alternative is implemented. Thus, Energy Harbor cannot forecast a level of impact for this resource area without unreasonable speculation.

Table 8.0-2 Alternatives Features Comparison Summary

	NGCC Plant	Combination
Summary of Alternative	Multiple combustion turbines assembled in appropriate power train configurations for a total of 1,468 MWe (gross) (Section 7.2.3.1).	Multiple combustion turbines assembled in appropriate power train configurations for a total of 954 MWe (gross); six 125-MWe solar installations with battery storage; 568 MWe supplied by wind turbines (Section 7.2.3.2).
Location	PNPP site (Section 7.2.3.1.1).	NGCC: PNPP Solar: offsite in Ohio. Wind: offsite in Ohio (Section 7.2.3.2).
Cooling System	Closed-cycle cooling (Section 7.2.3.1).	NGCC: closed-cycle cooling (Section 7.2.3.2). Solar and Wind: no cooling system required.
Land Requirements	59 acres on existing PNPP site (Section 7.2.3.1.1).	NGCC: bounded by NGCC alternative. Solar: six sites of 993 acres each, 5,960 acres total. Wind: construction footprint of 1,330 acres and a permanent footprint of 400 acres. New transmission: 4,090 acres total for the six solar and three wind installations (Section 7.2.3.2.1).
Workforce	Peak construction workforce of 1,200 and construction duration of 2-3 years; operations workforce of 150 (Section 7.2.3.1.9).	NGCC: bounded by that of the NGCC alternative (Section 7.2.3.1.9) Solar and Wind: construction workforce small for a short duration; operational workforce would be small and not a quantifiable impact on the local economy (Section 7.2.3.2.9).

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 1 of 13)

Land Use	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Onsite land use Offsite land use
Termination of Operations and Decommissioning	**SMALL:** Temporary onsite land use changes during decommissioning are anticipated to be comparable to changes that occur during construction and operations and would not require additional land. Temporary changes in onsite land use would not change the fundamental use of the reactor site. (NRC 2013a)
NGCC Plant	**SMALL:** Would be sited at PNPP site on approximately 59 acres. The site is zoned industrial. Connection would be made to the existing natural gas transmission line located along the PNPP's southern boundary.
Combination	**MODERATE to LARGE:** NGCC component bounded by NGCC plant alternative above. Solar land use would be six sites of approximately 1,000 acres. Wind would be three sites with total construction footprint of 1,330 acres and permanent footprint of 400 acres. Transmission connections assumed new transmission corridors for each solar and wind site totaling approximately 4,090 acres. All the solar, wind, and transmission acres would be converted to power generation land use.
Visual Resources	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue finding for aesthetic impacts in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of Operations and Decommissioning	**SMALL:** Terminating nuclear power plant operations would not change the visual appearance of the nuclear power plant until demolition of structures. Decommissioning activities would be localized and reduced with implementation of BMPs. (NRC 2013a)
NGCC Plant	**SMALL (plant):** The visual resources impact for the NGCC units and MDCTs would be similar to that of the existing plant.
Combination	**SMALL to MODERATE:** NGCC component same as for NGCC plant alternative above**.** Site selection would seek to minimize visual impacts and site selection would avoid impacting scenic areas for the solar and wind installations. The turbines would have obstruction lighting.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 2 of 13)

Air Quality	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Air quality impacts (all plants) Air quality effects of transmission lines
Termination of Operations and Decommissioning	**SMALL:** After termination of operations, air emissions from the nuclear power plant would continue, but at greatly reduced levels. The most likely impact of decommissioning on air quality is degradation by fugitive dust. Use of BMPs, such as seeding and wetting, can be used to minimize fugitive dust. (NRC 2013a)
NGCC Plant	**SMALL** (construction): Construction impacts would be temporary. Emissions being maintained within regulatory limits. **MODERATE** (operations): The NGCC plant would be a major source of criteria pollutants and GHGs. Annual emission estimates during the operations period based on EPA emission factors are presented in Table 7.2-1.
Combination	**SMALL** (construction): Construction impacts would be temporary. Emissions being maintained within regulatory limits. **MODERATE** (operations): The NGCC plant would be a major source of criteria pollutants and GHGs. Annual emission estimates during the operations period based on EPA emission factors are presented in Table 7.2-1. The solar and wind installations would not release any air emissions during operation.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 3 of 13)

Noise	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue finding for noise impacts in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of Operations and Decommissioning	**SMALL:** During decommissioning, noise would generally be far enough away from sensitive receptors outside the plant boundaries that the noise would be attenuated to nearly ambient levels and would be scarcely noticeable offsite. Noise abatement procedures could also be used during decommissioning to reduce noise. (NRC 2013a)
NGCC Plant	**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would be similar to those currently associated with PNPP with the exception of the MDCTs. Sound levels would attenuate and impacts to sensitive receptors is not expected.
Combination	**SMALL to MODERATE (construction):** NGCC component same as for NGCC plant alternative above. Noise impacts from land clearing for solar and the number of turbines that would need to be installed, would range from SMALL to MODERATE dependent on proximity to sensitive receptors. **SMALL (operations):** NGCC component same as for NGCC plant alternative above. During operations, the wind turbines would emit sound that is considered a nuisance but not harmful to human health. No noise impacts would occur from operation of the solar installations.
Geology and Soils	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue finding for geology and soils in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of Operations and Decommissioning	**SMALL:** Termination of nuclear plant operations is not expected to impact geology and soils. Erosion problems could be mitigated by using BMPs during decommissioning. Site geologic resources would not be affected by decommissioning. (NRC 2013a)
NGCC Plant	**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
Combination	**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 4 of 13)

Surface Water	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Surface water use and quality (non-cooling system impacts) Altered current patterns at intake and discharge structures Scouring caused by discharged cooling water Discharge of metals in cooling system effluent Discharge of biocides, sanitary waste, and minor chemical spills Temperature effects on sediment transport capacity
Termination of Operations and Decommissioning	**SMALL:** The NRC concluded that the impacts on water use and water quality from decommissioning would be SMALL for all plants. (NRC 2013a)
NGCC Plant	**SMALL:** Municipal supply would be used to support construction. Construction impacts would be minimized through adherence to permit requirements and implementation of BMPs. During operations, impacts to surface water would be related to use of Lake Erie to supply makeup water. The NGCC plant would consume approximately 4.21 MGD. Water discharges to Lake Erie would be regulated under a NPDES permit to protect water quality.
Combination	**SMALL (NGCC):** NGCC component same as for NGCC plant alternative above. **SMALL (solar and wind):** Water needs would be met in compliance with any required water withdrawal permits and applicable regulations. Water quality impacts could result from erosion and runoff associated with the construction of the solar and wind installations. These temporary soil impacts would be minimized by implementation of BMPs and compliance with stormwater permits and applicable regulations. Once in operation, the installations would be operated in compliance with stormwater regulations.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 5 of 13)

Groundwater	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue finding for groundwater contamination and use (non-cooling system impacts); groundwater use conflicts (plants that withdraw less than 100 gpm); and groundwater quality degradation resulting from water withdrawals in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. **SMALL:** (radionuclides released to groundwater): Tritium was not detected in the groundwater monitoring wells above the drinking water standard of 20,000 pCi/L for 2017 through 2021. No unplanned liquid or gaseous radioactive releases reaching groundwater have occurred at PNPP 2017–2020. In 2021 there were no abnormal gaseous releases and two abnormal liquid releases.
Termination of Operations and Decommissioning	**SMALL:** Decommissioning activities include some that may affect groundwater quality through the infiltration of water used for various purposes (e.g., cooling of cutting equipment, decontamination spray, and dust suppression). BMPs are expected to be employed as appropriate to collect and manage these waters. Groundwater chemistry may change as rainwater infiltrates through rubble. The increased pH could promote the subsurface transport of radionuclides and metals. However, this effect is expected to occur only over a short distance as a function of the buffering capacity of soil. Offsite transport of groundwater contaminants is not expected. (NRC 2013a)
NGCC Plant	**SMALL:** Compliance with permit conditions, adherence to stormwater regulations, and applying SWPPP mitigation and BMPs would minimize impacts during construction and operation.
Combination	**SMALL:** NGCC component same as for NGCC plant alternative above. Water needs for the solar and wind installations would be met in compliance with any required water withdrawal permits and applicable regulations.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 6 of 13)

Terrestrial	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Exposure of terrestrial organisms to radionuclides Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds) Bird collisions with plant structures and transmission lines Transmission line right-of-way management impacts on terrestrial resources Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) **SMALL** (effects on terrestrial resources, non-cooling system impacts): Adequate management programs and regulatory controls in place to protect onsite important terrestrial ecosystems.
Termination of Operations and Decommissioning	**SMALL:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect terrestrial biota, but at a reduced level of impact. Areas disturbed or used to support decommissioning are within the operational areas of the site and are also within the protected area. Decommissioning activities conducted within the operational areas are not expected to have a detectable impact on important terrestrial resources. (NRC 2013a)
NGCC Plant	**SMALL:** The PNPP site is forest where enough continuous acreage exists, approximately 59 acres. The clearing of vegetation and tree removal would displace wildlife that occupies the industrial site, and these would disperse to nearby habitats.
Combination	**SMALL to MODERATE:** NGCC component bounded by the NGCC plant alternative above. The large land requirement for offsite solar and wind installations could impact terrestrial habitats; however, OPSB certification requirements suggest avoidance of wetlands and other high-quality terrestrial habitats such as critical habitat for threatened and endangered species and habitats identified as a priority for preservation. The operation of the wind turbines could affect avian and bat species. Following USFWS and guidance for siting would minimize impacts and compliance with any incidental take permits would minimize impacts to special status species.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 7 of 13)

Aquatic	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Impingement and entrainment of aquatic organisms (plants with cooling towers) Entrainment of phytoplankton and zooplankton (all plants) Thermal impacts on aquatic organisms (plants with cooling towers) Infrequently reported thermal impacts (all plants) Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication Effects of nonradiological contaminants on aquatic organisms Exposure of aquatic organisms to radionuclides Effects on aquatic resources (non-cooling system impacts) Impacts of transmission line right-of-way management on aquatic resources Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses
Termination of Operations and Decommissioning	**SMALL:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Some aquatic organisms may have become established in the mixing zone because of the warmer environment, and these organisms likely would be adversely affected as the original conditions are restored within the body of water. The NRC concluded that for facilities at which the decommissioning activities would be limited to existing operational areas, the potential impacts on aquatic resources would be SMALL. (NRC 2013a)
NGCC Plant	**SMALL:** Adherence to permits and implementation of BMPs would minimize impacts on aquatic ecosystems during construction. Use of closed-cycle cooling system would minimize impingement and entrainment of aquatic organisms. Compliance with NDPES permit for discharge would minimize impacts to water quality.
Combination	**SMALL:** NGCC plant component of the combination alternative would be similar to those associated with the NGCC plant alternative but requiring about 35 percent less intake and discharge volume. No impacts to aquatic resources would result from the construction of the solar and wind components of the combination alternative due to the implementation of BMPs to control erosion and run-off. No operations-related impacts are associated with the solar and wind components of the combination alternative.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 8 of 13)

Special Status Species	
Proposed Action	**NO EFFECT to MAY AFFECT, NOT LIKELY to ADVERSELY AFFECT:** No LR-related refurbishment or other LR-related construction activities have been identified. Administrative controls are in place at PNPP to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs. The proposed LR would have no effect on the majority of the protected species. Due to the presence of suitable habitat, piping plover, red knot, and monarch butterfly species may be affected, but not likely to be adversely affected by continuing operations.
Termination of Operations and Decommissioning	**Site Specific:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. Some aquatic organisms may have become established in the mixing zone because of the warmer environment, and these organisms likely would be adversely affected as the water temperature cooled and the original conditions were restored within the body of water. The magnitude of impacts could vary widely based on site-specific conditions at the time of decommissioning and the presence or absence of special status species and habitats when the alternative is implemented. (NRC 2013a)
NGCC Plant	**MAY AFFECT, NOT LIKELY to ADVERSELY AFFECT:** The PNPP site is forest where enough acreage, approximately 59 acres, is available for the NGCC plant. The site has suitable habitat for protected species. The clearing of vegetation and tree removal would displace wildlife that occupies the industrial site, and these would disperse to nearby habitats.
Combination	**MAY AFFECT, NOT LIKELY to ADVERSELY AFFECT:** NGCC component bounded by that of the NGCC plant alternative above. The large land requirement for offsite solar and wind installations could impact terrestrial habitats; however, OPSB certification requirements suggest avoidance of critical habitat for threatened and endangered species and habitats identified as a priority for preservation. The operation of the wind turbines could affect protected avian and bat species. Following USFWS and guidance for siting would minimize impacts and compliance with any incidental take permits would minimize impacts to special status species.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 9 of 13)

Historic and Cultural Resources	
Proposed Action	**NO ADVERSE EFFECT:** No LR-related refurbishment or construction activities identified; administrative controls ensure protection of cultural resources in the event of excavation activities.
Termination of Operations and Decommissioning	**NO ADVERSE EFFECT:** The termination of nuclear plant operations would not affect historic or cultural resources. The NRC conducted an analysis of the potential effects of decommissioning on historic and archaeological (cultural) resources and found that the potential onsite impacts at sites where the disturbance of lands would not go beyond the operational areas would be SMALL. (NRC 2013a)
NGCC Plant	**NO EFFECT to ADVERSE EFFECT:** Siting the NGCC at PNPP would require land that has not been surveyed for cultural resources and the vicinity is described as archaeologically sensitive. Ohio does not require the protection of cultural resources on private lands and no federal permit would be required for upland construction activities for the NGCC. Prior to issuing a certificate for a new generating facility, the OPSB would consider impacts to registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significance within ten miles of the project area.
Combination	**NO EFFECT to ADVERSE EFFECT:** Ohio does not require the protection of cultural resources on private lands and no federal permit would be required for upland construction activities for the new generating installations. Prior to issuing a certificate for a new generating facility, the OPSB would consider impacts to registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significance within ten miles of the project area. Depending on the site locations, archaeological and other cultural resources could be affected.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 10 of 13)

Socioeconomics	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Employment and income, recreation, and tourism; Tax revenues; Community services and education; Population and housing; Transportation.
Termination of Operations and Decommissioning	**SMALL to MODERATE (termination):** There would be immediate socioeconomic impacts from the loss of jobs. The impacts from the loss or reduction of tax revenue due to the termination of plant operations on community and public education services could range from SMALL to LARGE. (NRC 2013a) The tax payments attributable to PNPP provide a SMALL beneficial economic impact to Lake County. Loss of the operational and temporary (outage) personnel would affect various aspects of the local community including employment, taxes, housing, off-site land use, economic structure, and public services. **SMALL (decommissioning):** Decommissioning itself has no impact on the tax base and no detectable impact on the demand for public services. The impacts of decommissioning on socioeconomics are neither detectable nor destabilizing; therefore, the impacts on socioeconomics are SMALL. (NRC 2002)
NGCC Plant	**SMALL:** The construction and operations employment would provide a stimulus to the local economy (**beneficial** impact) as well as include demands in community services (**adverse** impact). The size of the construction workforce and duration of construction would temporarily stimulate the local economy. Economic impact of construction and operations employment and tax payments would be SMALL in Lake County. **SMALL to MODERATE (construction traffic); SMALL (operations traffic):** Construction commuting would increase traffic and congestion on the local roadways. Transportation impacts would decrease after construction.
Combination	**SMALL:** NGCC component bounded by the NGCC plant alternative above. The jobs created to complete the construction of solar and wind installations would less than those needed for the NGCC plant and provide a SMALL beneficial impact in host counties. **SMALL to MODERATE (construction traffic); SMALL (operations traffic):** NGCC component bounded by the NGCC plant alternative above. Construction could increase traffic on the local roads for construction of the solar and wind installations temporarily. Very few employees are required for maintenance and operation of solar and wind installations.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 11 of 13)

Human Health	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Radiation exposures to the public Radiation exposures to plant workers Human health impact from chemicals Microbiological hazards to plant workers Physical occupational hazards **SMALL** (microbiological hazards to the public): PNPP's thermal discharge offshore, submerged discharge to Lake Erie would not enhance the concentration of thermophilic organisms. The thermal plume temperatures would be well below the optimum growth temperature for thermophilic organisms of particular concern. **SMALL** (electric shock hazards): In-scope transmission lines are located entirely within PNPP's OCA area and comply with current NESC clearance standards. Energy Harbor also has procedures in place to review and control proposed structural changes to maintain compliance with the NESC clearance standards. Procedures govern the use of equipment near transmission lines to maintain adequate distance to prevent electrical shock.
Termination of Operations and Decommissioning	**SMALL:** The human health impacts from physical, chemical, and microbiological hazards during the termination of plant operations and decommissioning would be SMALL for all plants. (NRC 2013a)
NGCC Plant	**SMALL (construction); SMALL to MODERATE (operations):** Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction and operation. The radiological human health impact on workers due to working in proximity to PNPP would be SMALL due to compliance with NRC regulations and adherence to ALARA principles. The NGCC plant would emit criteria air pollutants that can create health problems. Technology will be installed to limit the criteria air pollutant releases.
Combination	**SMALL (construction); SMALL to MODERATE (operations):** Compliance with OSHA worker protection rules would control impacts on workers from construction activities. Wind turbines sound is considered a nuisance rather than harmful to human health. The transmission lines for solar and wind installations would be designed in compliance with NESC clearance requirements to protect the public from electric shock. The radiological human health impact on workers due to working in proximity to PNPP would be SMALL due to compliance with NRC regulations and adherence to ALARA principles. The NGCC plant would emit criteria air pollutants that can create health problems. Technology will be installed to limit the criteria air pollutant releases.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 12 of 13)

Environmental Justice	
Proposed Action	**No disproportionately high and adverse impacts to minority and low-income populations:** The closest minority population is adjacent to the western side of the PNPP site, and the closet low-income population is 6 miles southwest of the site center point. (Section 3.11.2). Based on known pathways, there are no expected disproportionately high and adverse impacts on minority or low-income populations from the proposed action (Section 4.10.1.4.2).
Termination of Operations and Decommissioning	Termination of power plant operations and the resulting loss of jobs, income, and tax revenue could have a disproportionate effect on minority and low-income populations (NRC 2013a). **Site Specific:** The determination of whether the minority or low-income populations are disproportionately highly and adversely impacted by facility decommissioning activities needs to be made on a site-by-site basis because their presence and their socioeconomic circumstances will be site specific (NRC 2002).
NGCC Plant	**No disproportionately high and adverse impacts to minority and low-income populations:** Potential adverse impacts on minority and low-income populations from the construction would primarily result from minor environmental impacts such as fugitive dust and noise and socioeconomic impacts from traffic and potential rental housing shortages. These impacts would be temporary and short in duration.
Combination	**No disproportionately high and adverse impacts to minority and low-income populations:** NGCC component same as for NGCC plant alternative above. Impacts during construction of solar and wind installations would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. Minor environmental impacts such as fugitive dust and noise and socioeconomic impacts from traffic could occur. These impacts would be temporary and short in duration. No disproportionately high and adverse effects would be expected for minority or low-income communities.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 13 of 13)

Waste Management	
Proposed Action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Low-level waste storage and disposal Onsite storage of spent nuclear fuel Offsite radiological impacts of spent nuclear fuel and high-level waste disposal Mixed waste storage and disposal Nonradioactive waste storage and disposal
Termination of Operations and Decommissioning	**SMALL:** After termination of nuclear plant operations, there would be a period before the beginning of decommissioning when the reactor would be placed in a cold shutdown condition and maintained. The quantities of waste generated would be smaller than the quantities generated during either operations or decommissioning. The impacts associated with the management of LLRW, hazardous waste, mixed waste, and nonradioactive and nonhazardous waste during operations and decommissioning would be SMALL. (NRC 2013a)
NGCC Plant	**SMALL:** Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; spent selective catalytic reduction catalysts would make up the majority of the waste during operations; operations-related waste would be managed and recycled or disposed of at permitted offsite facilities.
Combination	**SMALL:** NGCC component same as for NGCC plant alternative above. Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; during operations, nonhazardous and hazardous wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities.

9.0 STATUS OF COMPLIANCE

The environmental report shall list all federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by federal, state, regional, and local agencies having responsibility for environmental protection. [10 CFR 51.45(d)]

9.1 PNPP Authorizations

Table 9.1-1 provides a summary of the authorizations held by PNPP for current plant operations. Authorizations in this context include any permits, licenses, approvals, or other entitlements that would continue to be in place, as appropriate, through the proposed LR operating term given their respective renewal schedules. Table 9.1-2 lists additional environmental authorizations and consultations related to the renewal of PNPP Unit 1 OL.

Table 9.1-1 Environmental Authorizations for Current PNPP Operations (Sheet 1 of 2)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
NRC	Atomic Energy Act [10 CFR Part 50]	PNPP license to operate Unit 1	NPF-58	Issued: 11/13/1986 Expires: 11/7/2026	Operation of PNPP Unit 1.
NRC	NRC Regulations 10 CFR Part 72	General license for storage of fuel at power reactor sites	General License	N/A	Storage of power reactor spent fuel and other associated radioactive materials in an ISFSI.
USDOT	49 USC 5180 [49 CFR Part 107, Subpart G]	Registration	Reg. No: 050421550022D	6/30/2022	Hazardous material shipment
Tennessee Department of Environment and Conservation (TDEC)	TDEC Rule 0400-20-10-.32	License to ship radioactive material	T-OH001-L22	12/31/2022	Shipment of radioactive material to a licensed disposal/processing facility in Tennessee.
EPA and OEPA	40 CFR 262; OAC 3745-52	Hazardous waste generator registration	EPA/OEPA ID #: OHD025673518	N/A	Small to large quantity generator of hazardous and mixed wastes.
OEPA	Clean Water Act Section 401 [33 USC 1341]	Certification of water quality standards	OEPA ID No: 154766	N/A	Section 401 Water Quality Certification issued by the state for operation of PNPP.

Table 9.1-1 Environmental Authorizations for Current PNPP Operations (Sheet 2 of 2)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
OEPA	Federal Clean Water Act (33 USC 1251 et. Seq.), Ohio Water Pollution Control Act (ORC Section 6111)	NPDES Permit	3IB00016*LD	2/28/2023	Authorize discharges of PNPP wastewaters and industrial stormwaters into Lake Erie.
OEPA	OAC Chapter 3745-31	Permit to install and operate air contaminant source(s)	P0111998	6/18/2024	Operation of 2 auxiliary boilers.
Ohio Department of Commerce, Division of State Fire Marshal	OAC 1301:7-9-04	Underground storage tank registration	Facility #: 43007657	Renewed annually	Registration of underground storage Tanks T00001 through T00006.
ODNR	ORC Section 1506.11	Lake Erie Halite Non-Extraction Lease	HNL-001-LA	5/14/2072	A mineral rights lease that prevents the extraction of the mineral halite within a 410-acre submerged land area of Lake Erie.
ODNR	ORC Section 1501.01 ORC Section 1506.10 ORC Section 1506.11	Lake Erie Submerged Lands Lease	SUB-0528-LA	5/14/2072	Covers approximately 3,500-ft of shoreline protection and includes the intake and discharge tunnels.

Table 9.1-2 Environmental Authorizations and Consultations for PNPP License Renewal (Sheet 1 of 2)

Agency	Authority	Requirement	Remarks
NRC	Atomic Energy Act [42 USC 2011 *et seq*.]	License renewal	Applicant for federal license must submit an ER in support of a license renewal application.
USFWS	Endangered Species Act, Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS, regarding federally protected species.
NOAA	Endangered Species Act, Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing license to consult with the USFWS and NOAA Fisheries if applicable, regarding federally protected species.
ODNR Division of Wildlife	Endangered Species Act, Section 7 [16 USC 1536]	Consultation	Applicant may consult with state agency to support a timely and thorough review of potential impacts to threatened and endangered species and important habitats.
ODNR Coastal Management Program	Coastal Zone Management [16 USC 1451]	Certification	Applicant seeking federal license for a project within the boundaries of the coastal zone must obtain state certification that proposed action would comply with State Coastal zone Management Program.
OEPA	Clean Water Act, Section 401 [33 USC 1341]	Certification	State-issued Section 401 certification for operation of PNPP (Attachment E).
Ohio State Historic Preservation Office	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.

Table 9.1-2 Environmental Authorizations and Consultations for PNPP License Renewal (Sheet 2 of 2)

Agency	Authority	Requirement	Remarks
Ohio History Connection	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing license to consider cultural impacts.
Hannahville Indian Community, Michigan	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Little Traverse Bay Bands of Odawa Indians, Michigan	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Seneca Nations of Indians	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Seneca-Cayuga Nation	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Miami Tribe of Oklahoma	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Eastern Shawnee Tribe of Oklahoma	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.

9.2 Status of Compliance

PNPP has established control measures in place to ensure compliance with the authorizations listed in Table 9.1-1, including monitoring, reporting, and operating within specified limits. PNPP environmental compliance coordinators are responsible for monitoring and ensuring that the site complies with its environmental permits and applicable regulations. Monitoring and sampling results associated with the environmental programs submitted to appropriate agencies, as specified in the permits and/or governing regulations.

9.3 Notices of Violations

Based on a review of records over the 5-year period of 2017-2021 of various programs and permits that PNPP is subject to and complies with, there have been no NOVs issued to the facility by the NRC, federal (i.e., agencies other than the NRC), state, or local regulatory agencies.

9.4 Remediation Activities

Based on reviews of records, no remediation activities for nonradioactive or radioactive environmental concerns have been conducted since 2014. PNPP conducts routine groundwater monitoring and reporting for tritium as part of the site's GPP. As discussed in Section 3.6.4.2.1, two tritium releases occurred in 2020, but based on guidance in NEI 07-07, there is no requirement for notification to the NRC or local officials and no requirement for remediation as tritium is not considered a license material.

There is a current radiological investigation for tritium in the underdrain system. On December 16, 2021, tritium was detected in Underdrain Manhole #20 during quarterly sampling by Chemistry. Subsequent sampling occurred the next day that confirmed there was detectable tritium activity. An investigation that included a Chemistry sampling plan and tritium action plan was put in place to identify the source of the tritium. Actions are still being performed and monitoring will continue as part of the groundwater protection program.

9.5 Federal, State, and Local Regulatory Standards: Discussion of Compliance

This section contains information regarding environmental programs identified in the GEIS that may or may not be applicable to the site, and the current status of compliance with each program.

9.5.1 Atomic Energy Act

9.5.1.1 Radioactive Waste

As discussed in Section 2.2.6, PNPP has radioactive waste stream and shipping procedures. As a generator of both LLRW and spent fuel, PNPP is subject to and complies with provisions and requirements of the Low-Level Radioactive Waste Policy Act of 1985 and the Nuclear Waste Policy Act of 1982, as subsequently amended.

9.5.2 Clean Air Act

9.5.2.1 Air Permit

PNPP operates its air emission sources in compliance with Ohio Administrative Code Chapter 3745-31. As discussed in Section 3.3.3.2, PNPP has a permit issued by the OEPA to operate two auxiliary boilers (Table 9.1-1). Operations of these air emission sources is maintained within the emission, opacity, fuel sulfur content, and fuel usage (as applicable) limits established in the permit, and PNPP submits emission reports to the OEPA annually as required.

9.5.2.2 Chemical Accident Prevention Provisions [40 CFR Part 68]

PNPP is not required to have a stand-alone risk management plan as described in 40 CFR Part 68 because the amount of regulated chemicals present onsite do not exceed the threshold quantities specified in 40 CFR 68.130. PNPP has a procedure in place that provides a listing of reportable quantities of on-site materials as well as the site's SPCC plan, SWPPP, and a listing of committed resources in the event of a spill.

9.5.2.3 Stratospheric Ozone [40 CFR Part 82]

Under Title VI of the CAA, the EPA is responsible for several programs that protect the stratospheric ozone layer. Regulations promulgated by the EPA to protect the ozone layer are contained in 40 CFR 82. Refrigeration appliances and motor vehicle air conditioners are regulated under Section 608 and 609 of the CAA, respectively. A number of service practices, refrigerant reclamation, technician certification, and other requirements are covered by these programs. PNPP is in compliance with Sections of 608 and 609 of the CAA as amended in 1990 and the implementing of regulations codified in these regulations. The program to manage stationary refrigeration appliances at PNPP is described in Energy Harbor's corporate procedures and is applicable to employees, vendors, and contractors for the management of refrigerants in compliance with federal regulations.

9.5.3 Clean Water Act

9.5.3.1 Water Quality (401) Certification

Federal CWA Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters provide the licensing agency with either a waiver from the state or a certification from the state that the discharge will comply with applicable CWA requirements [33 USC 1341]. PNPP applied for 401 certification on December 19, 2014 and was issued Section 401 Water Quality Certification by the OEPA on January 30, 2017. The letter confirmed that 401 certification shall remain valid and in effect so long as the NRC operating license for PNPP is in effect. The 401 application, public notice, and OEPA letters are included in Attachment E. (OEPA 2022f)

9.5.3.2 NPDES Permit

NPDES permit No. 3IB00016*LD, issued by the OEPA on October 6, 2020, authorizes the discharge of wastewaters into Lake Erie. As discussed in Section 3.6.1.2.1, plant effluent is discharged to Lake Erie via NPDES outfalls and requires monitoring of water quality and effluent limits. The outfalls are depicted in Figure 3.6-3 and their associated effluent limits are listed in Table 3.6-2. Based on review of its compliance history for the 5-year period of 2017 through 2021, PNPP has not received any NPDES-related NOVs or non-conformance notifications and is compliant with regulations and conditions set forth in the permit.

9.5.3.3 Industrial Stormwater Discharge

As discussed in Section 3.6.1.2.2. stormwater discharges associated with PNPP industrial activities are regulated and controlled through the site's NPDES permit. PNPP also implements and maintains a SWPPP for the facility that identifies potential sources of pollution that would reasonably be expected to affect the quality of stormwater and identify BMPs that will be used to prevent or reduce the pollutants in stormwater discharge. PNPP is in compliance with regulations and conditions set forth in the permit.

9.5.3.4 Sanitary Wastewaters

As discussed in Section 3.6.1.2.3, PNPP sanitary wastewater has been discharged to the Lake County Department of Utilities since the middle to late 1980s, and there is no sanitary wastewater treatment onsite.

9.5.3.5 Spill Prevention, Control, and Countermeasures

The EPA's Oil Pollution Prevention Rule became effective January 10, 1974 and was published under the authority of Section 311(j)(1)(C) of the Federal Water Pollution Control Act. The regulation has been published in 40 CFR Part 112, and facilities subject to the rule must prepare and implement an SPCC plan to prevent any discharge of oil into or upon navigable waters of the United States or adjoining shorelines. PNPP is subject to this rule and has a written SPCC as part of the site's Oil/Chemical Release Contingency Plan that identifies and describes the procedures, materials, equipment, and facilities that are utilized at the plant to minimize the frequency and severity of oil spills to meet the requirements of this rule.

9.5.3.6 Reportable Spills [40 CFR Part 110]

PNPP is subject to the reporting provisions of 40 CFR Part 110 as it relates to the discharge of oil in such quantities as may be harmful pursuant to Section 311(b)(4) of the Federal Water Pollution Control Act. Any discharges of oil in such quantities that may be harmful to public health, welfare, or the environment must be reported to the EPA's national response center. Based on a review of site records from 2017-2021, there have been no releases at PNPP that have triggered this notification requirement.

9.5.3.7 Reportable Spills [ORC 3750.06]

PNPP is subject to the reporting provision of ORC 3750.06 for reporting an accidental or intentional release of extremely hazardous substances (40 CFR Part 355; Appendix A and B) and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Hazardous Substance (40 CFR Part 302; Table 302.4), or any release of 25 gallons or more of oil into the environment or any quantity of oil into or upon navigable waters which causes a visible film or sheen upon the surface of the water. Any such event must be reported verbally to the fire department, local emergency planning committee, and the OEPA within 30 minutes of the incident. Additionally, a call must be made to the National Response Center for releases of oil to navigable waters. A written follow-up emergency notice must be submitted within 30 days to the OEPA Emergency Response Section and the local planning committee of the planning district in which the release occurred, and then the report is sent to the State Emergency Response Commission. (OEPA 2022g) Based on a review of records from 2017-2021, there have been no releases at PNPP that triggered the notification requirement.

9.5.3.8 Facility Response Plan

PNPP is not subject to the facility response plan risk requirement of 40 CFR 112.20 because the facility does not transfer oil over water to or from vessels and does not store oil in quantities greater than 1 million gallons.

9.5.3.9 Section 404 Permit

Currently, PNPP does not have any Section 404 permits in place because PNPP does not have any dredge and fill activities. However, PNPP would comply with regulatory requirements imposed by the USACE under Section 404 as it relates to performing future activities in federal jurisdictional waters when appropriate.

9.5.4 Safe Drinking Water Act

As discussed in Section 3.6.3, PNPP receives its potable water supply from the Lake County Department of Utilities and does not have an active well subject to the Safe Drinking Water Act limits.

9.5.5 Endangered Species Act

Potential impacts to state and federally listed species were considered in PNPP's review and analysis in Section 4.6.6, and it was concluded that none would likely be adversely affected as a result of the proposed LR. Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of species that are listed or proposed for listing as endangered or threatened. Depending on the action involved, the ESA requires consultation with the USFWS and with the NOAA Fisheries if marine or anadromous species could be affected. Although PNPP has invited comment from the USFWS (Attachment C) during the development of this ER, a more structured consultation process with these agencies may be initiated by the NRC per Section 7 of the ESA.

9.5.6 Migratory Bird Treaty Act

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell birds listed, and grants protection to any bird parts, including feathers, eggs, and nests. PNPP adheres to the MBTA and does not currently hold any MBTA-related permits.

9.5.7 Bald and Golden Eagle Protection Act

The BGEPA prohibits the take, transport, sale, barter, trade, import and export, and possession of bald and golden eagles, making it illegal for anyone to collect eagles and eagle parts, nests, or eggs without a USFWS permit. As discussed in Section 3.7.8.2, bald eagles have been observed at the PNPP site as recently as 2021, but there are currently no known nests onsite and no BGEPA permitting requirements associated with PNPP operations.

9.5.8 Magnuson-Stevens Fishery Conservation and Management Act

As discussed in Section 3.7.8.4, no HAPC or EFH areas protected from fishing are located within 6 miles of PNPP. Therefore, there are no Magnuson-Stevens Fishery Conservation and Management Act restrictions applicable to PNPP operations.

9.5.9 Marine Mammal Protection Act

The Marine Mammal Protection Act prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. There are currently no Marine Mammal Protection Act permitting requirements associated with PNPP operations.

9.5.10 Coastal Zone Management Act

The Federal Coastal Zone Management Act (CZMA) [16 USC 1451 et seq.] imposes requirements on an applicant for a federal license to conduct an activity that could affect a state's coastal zone. The CZMA requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal management program [16 USC 1456(c)(3)(A)]. NOAA has promulgated implementation regulations that indicate that the requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The regulation requires that the license applicant provides its certification to the federal licensing agency and a copy to the applicable state agency [15 CFR 930.57(a)].

The NRC's office of Nuclear Reactor Regulation has issued guidance to staff regarding compliance with the Act. This guidance acknowledges that Ohio has a federally approved coastal management program (NRC 2013e). Ohio's Coastal Management Program (OCMP) is administered by the ODNR and includes portions of nine counties and 312 miles of Ohio's Lake Erie coast (ODNR 2022i). PNPP, located on the shores of Lake Erie in Lake County, is located within Ohio's Coastal Management Area inland boundary. Therefore, Energy Harbor is required to provide a CZMA certification to the state of Ohio for the proposed PNPP LR project.

Energy Harbor developed a CZMA consistency certification for the project. The certification demonstrates the project is consistent with the enforceable policies of the OCMP and will be conducted in a manner consistent with the program. ODNR concurred that the proposed action is consistent with the OCMP provided all applicable permits and approvals are obtained as further described in the letter. Attachment F includes a copy of Energy Harbor's and ODNR's correspondence regarding a certification of compliance with Ohio's enforceable coastal zone policies. Therefore, PNPP has fulfilled the regulatory requirement to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved OCMP for the Ohio coastal zone.

9.5.11 National Historic Preservation Act

Potential impacts on historical properties are discussed in Section 4.7.4.2. As discussed in Section 3.8.6, cultural resources on the PNPP site are protected by administrative procedures. The procedures ensure that any unknown historic or cultural resources that may be discovered on the site are identified and protected.

Section 106 of the NHPA requires federal agencies having the authority to license any undertaking, prior to issuing the license, to consider the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for establishing an agreement with any SHPO to substitute state review for council review [35 CFR 800.7]. Although not required of an applicant by federal law or NRC regulation, to provide early consultation for the Section 106 process, Energy Harbor contacted the Ohio State Historic Preservation Office for informal consultation concerning PNPP LR and potential effects on cultural resources within the approximate 1,030-acre site and on historic properties within a 6-mile radius of PNPP (Attachment D). Native American groups recognized as potential stakeholders were also consulted by Energy Harbor with the opportunity for comment (Attachment D).

9.5.12 Resource Conservation and Recovery Act

9.5.12.1 Nonradioactive Waste

As a generator of hazardous and nonhazardous wastes, PNPP is subject to and complies with the RCRA and specific OEPA regulations contained in Ohio Administrative Code 3745-52. PNPP is classified as a small quantity generator of hazardous waste (EPA 2022e). As a generator of hazardous waste, PNPP also maintains a hazardous waste generator identification number (Table 9.1-1). Based on review of its compliance history for the previous five years (2017-2021), PNPP has not received any NOVs for hazardous waste management.

9.5.12.2 Reportable Spills [40 CFR Part 262]

PNPP is subject to the reporting provisions of 40 CFR 262.34(d)(5)(iv)(C) as it relates to a fire, explosion, or other release of hazardous waste which could threaten human health outside the facility boundary or when the facility has knowledge that a spill has reached a surface water. Any such event must be reported to the EPA's national response center. Based on review of records for the previous five years (2017-2021), there have been no releases at PNPP that triggered this notification requirement.

9.5.12.3 Mixed Waste

Radioactive materials are regulated by the NRC under the Atomic Energy Act of 1954, and hazardous waste are regulated by the EPA under the RCRA of 1976. Management of radioactive waste at PNPP is discussed in Section 2.2.6. PNPP's management of its waste streams is in compliance with applicable regulatory standards and has not resulted in any NOVs for the 2017-2021 timeframe. PNPP will continue to store and dispose of hazardous and nonhazardous wastes in accordance with EPA and state regulations and dispose of the wastes in appropriately permitted treatment and disposal facilities during the proposed LR operating term.

9.5.12.4 Underground Storage Tanks (OAC 1301:7-9-04)

PNPP has six underground storage tanks (UST) registered with the Ohio Department of Commerce, Division of State Fire Marshal (Table 9.1-1). Two 90,000-gallon tanks and one 39,375-gallon tank contain diesel fuel for emergency generators. A third 90,000-gallon tank is used for fuel transfer/temporary storage when one of the three Unit 1 tanks is being inspected or cleaned. The remaining two tanks are empty. All six of the tanks are part of the emergency generator system at a nuclear power generation facility and therefore are exempt from further regulation pursuant to paragraph (E)(4) of OAC 1301:7-9-01.

9.5.12.5 Above Ground Storage Tanks

There are 22 above ground storage tanks onsite with varying capacities from 120 to 500,000 gallons. The tanks are covered by PNPP's SPCC plan, which is included as part of the site's PAP-0806 Oil/Chemical Contingency Plan.

9.5.12.6 Reportable Spills [ORC 3750.06]

PNPP is subject to the reporting provision of ORC 3750.06 for reporting an accidental or intentional release of extremely hazardous substances (40 CFR Part 355; Appendix A and B), CERCLA Hazardous Substance (40 CFR Part 302; Table 302.4), or any release of 25 gallons or more of oil into the environment or any quantity of oil into or upon navigable waters which causes a visible film or sheen upon the surface of the water. Any such event must be reported verbally to the fire department, local emergency planning committee, and the Ohio EPA within 30 minutes of the incident. Additionally, a call must be made to the National Response Center for releases of oil to navigable waters. A written follow-up emergency notice must be submitted within 30 days to the OEPA Emergency Response Section and the local planning committee of the planning district in which the release occurred, and then the report is sent to the State Emergency Response Commission. (OEPA 2022g) Based on a review of site records from 2017-2021, no reportable above ground or UST releases of hazardous substance or petroleum products requiring reporting under this regulation have occurred.

9.5.13 Pollution Prevention Act

In accordance with RCRA Section 3002(b) and 40 CFR 262.27, a small or large quantity generator must certify that there is a waste minimization program in place to reduce the volume and toxicity of waste generated to the degree determined to be economically practical. PNPP is meeting this requirement as procedural measures are in place to minimize hazardous waste generated to the maximum extent practical.

9.5.14 Federal Insecticide, Fungicide and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act requires that pesticides distributed or sold in the United States must be registered (licensed) by the EPA. Commercially available EPA-registered herbicides and insecticides are applied by licensed contractors as needed.

9.5.15 Toxic Substances Control Act

The Toxic Substances Control Act of 1976 regulates PCBs [40 CFR Part 761] and asbestos [40 CFR Part 763], both of which may be present at PNPP. PNPP has a procedure which provides guidance for handling asbestos and PCBs to ensure compliance with state and federal regulations. PNPP is in compliance with the PCB and asbestos regulations applicable to the facility.

9.5.16 Hazardous Materials Transportation Act

Because PNPP ships hazardous materials regulated by the U.S. Department of Transportation offsite, the facility is subject to and complies with applicable requirements of the Hazardous Materials Transportation Act described in 49 CFR, including the requirement to possess a current hazardous materials certificate of registration (Table 9.1-1).

9.5.17 Emergency Planning and Community Right-to-Know Act

9.5.17.1 Section 312 Reporting [40 CFR 370]

PNPP is subject to and complies with Section 312 of the Emergency Planning and Community Right-to-Know Act that requires annual submittal of an emergency and hazardous chemical inventory report (Tier II) to the local emergency planning commission, the state emergency response committee, and the local fire department. This report typically includes, but is not limited to, chemicals such as amberlite cation and anion resins, diesel fuel, propane, freon, hydrazine, lead in batteries, sodium bisulfite, sulfuric acid batteries, sulfuric acid, propane, carbon dioxide, hydrogen, nitrogen, and other chemicals.

9.5.18 Comprehensive Environmental Response, Compensation, and Liability Act

PNPP is subject to the hazardous substance release and reporting provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as subsequently amended. Any release of reportable quantities of listed hazardous substances to the environment requires a notification to the EPA's National Response Center and the OEPA as appropriate and subsequent written follow-up. Based on review of records over the 5-year period of 2017-2021, there have been no releases at PNPP that have triggered this notification requirement.

9.5.19 Farmland Protection Policy Act

The FPPA applies to federal programs. The term "federal program" under this act does not include federal permitting or licensing for activities on private or non-federal lands. Therefore, because license renewal is considered a federal licensing activity and PNPP is located on non-federal lands, the FPPA is not applicable.

9.5.20 Federal Aviation Act

Coordination with the FAA is required when it becomes necessary to ensure the highest structures associated with a project do not impair the safety of aviation. Submission of a letter of notification (with accompanying maps and project description) to the FAA would result in a written response from the FAA certifying that no hazard exists or recommending project changes and/or the installation of warning devices such as lighting.

At PNPP, the site elevation is dominated by the two approximately 516-foot high natural-draft cooling towers. No license renewal-related construction activities have been identified; therefore, no new notifications to the FAA are required.

9.5.21 Occupational Safety and Health Act

OSHA governs the occupational safety and health of the construction workers and operations staff. PNPP and its contractors comply with OSHA's requirements, as these are incorporated in the site's occupational health and safety practices.

9.5.22 State Water Use Program

In accordance with ORC Section 1521.16, the ODNR requires that any owner of a facility, or combination of facilities, with the capacity to withdraw more than 100,000 gallons of water daily, register such facilities and file an annual report with the ODNR Division of Water Resources. As discussed in Section 3.6.3.1, PNPP withdraws surface water from Lake Erie. The facility is registered with the ODNR and provides annual water withdrawal use reports. PNPP is in compliance with the state's register and reporting requirements.

9.5.23 Zoning Requirements

As discussed in Section 3.2.1, the eastern two thirds of the PNPP site, which includes the power generating area, fall within the incorporated limits of North Perry and is zoned as a General Industrial District (I-2) according to the North Perry Village Planning and Zoning Code. The I-2 district accommodates industrial activities that are generally clean in character and generate limited outdoor activities that are clean, quiet, and free of hazardous and objectionable elements. Conditional uses for this zone include heavy manufacturing, earth removal, wireless telecommunication, and nuclear power electrical generation. The western third, which is primarily undeveloped, is within the boundaries of Perry TWP and is zoned Heavy Industrial District (I-3) by the Perry Township Zoning Resolution. The I-3 district allows for manufacturing, assembly, processing, storage, and similar industrial operations that may require outdoor storage of products or raw materials and may generate significant volumes of vehicular traffic. PNPP is in compliance with these zoning ordinances.

9.6 Environmental Reviews

PNPP has procedural controls in place to ensure all environmentally sensitive areas at PNPP, if present, are adequately protected during site operation and project planning. These controls, which encompass non-radiological environmental resource areas such as land use, air quality, surface water and groundwater, terrestrial and aquatic ecology, historic and cultural resources, waste management, and pollution prevention, consist of the following:

- Appropriate local, state, and/or federal permits are obtained or modified, as necessary.
- BMPs, including for stormwater, are implemented to protect wetlands and sensitive ecosystems.
- Appropriate agencies are consulted on matters involving federally and state-listed threatened, endangered, and protected species; BMPs are implemented to minimize impacts to these species.
- Appropriate agencies are consulted on matters involving cultural resources and to ensure BMPs are implemented to minimize impacts to this resource.

In summary, PNPP's administrative controls ensure that appropriate local, state, and/or federal permits are obtained or modified as necessary, that cultural resources and threatened and endangered species are protected if present, and that other regulatory issues are adequately addressed, as necessary.

9.7 Alternatives

The discussion of alternatives in the environmental report shall include a discussion of whether alternatives will comply with applicable environmental quality standard and requirements [10 CFR 51.45(d)].

The natural gas and combination of natural gas and renewables alternatives discussed in Chapter 7 would be constructed and operated to comply with all applicable environmental quality standards and requirements. While alternative generation would be developed and operated compliant with standards and requirements, additional environmental impacts associated with siting, construction, and operation would be realized. Continued compliant operation of PNPP would not result in these additional impacts.

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10.1 Figure references

No.	Title	References
2.2-1	Water Balance Diagram	
2.2-2	In-Scope Transmission Lines	ESRI 2020
3.1-1	PNPP Plant Layout	ESRI 2020; USDOT 2022
3.1-2	PNPP Area Topography	USDA 2022a
3.1-3	PNPP Site and 6-Mile Radius	USCB 2022a; USDOT 2022; USGS 2021a
3.1-4	PNPP Site and 50-Mile Radius	USCB 2022a; USDOT 2022; USGS 2021a; USGS 2021b
3.1-5	Federal, State, and Local Lands 6-Mile Radius of PNPP	LMP 2022; USCB 2022a; USDA 2022a; USDOT 2022; USGS 2021a
3.1-6	Federal, State, and Local Lands 50-Mile Radius of PNPP	LMP 2022; ODNR 2022a; USCB 2022a; USDA 2022a; USDOT 2022; USGS 2021a; USGS 2021b
3.2-1	Land Use/Land Cover, PNPP Site	ESRI 2020; MRLC 2021
3.2-2	Land Use/Land Cover 6-Mile Radius	ESRI 2020; MRLC 2021
3.3-1 through 3.3-5	Wind Rose	
3.3-6	Nonattainment and Maintenance Areas for Ozone 2008 and 2015	EPA 2022; USCB 2022a; USGS 2021a
3.3-7	Nonattainment and Maintenance Areas for Particulate Matter 2006 and 2012	EPA 2022; USCB 2022a; USGS 2021a
3.3-8	Nonattainment and Maintenance Areas for Particulate Matter 1987 and 1997	EPA 2022; USCB 2022a; USGS 2021a

No.	Title	References
3.3-9	Nonattainment and Maintenance Areas for Sulfur Dioxide 1971 and 2010	EPA 2022; USCB 2022a; USGS 2021a
3.3-10	Nonattainment and Maintenance Areas for Carbon Monoxide 1971 and 2008	EPA 2022; USCB 2022a; USGS 2021a
3.5-1	Physiographic Provinces	ESRI 2020; USCB 2022a; USGS 2022a
3.5-2	Surficial Geology Map, PNPP Property	ESRI 2020; USGS 2022b
3.5-3a	Geologic Cross-Section and Location at PNP	
3.5-4	Distribution of Soil Units, PNPP Property	ESRI 2020; USDA 2022b
3.5-5	Historic Seismic Events, 1970-2022	ESRI 2020; USGS 2022c
3.6-1	Vicinity Hydrological Features	USCB 2022a; USGS 2021a
3.6-2	FEMA Flood Zones at PNPP	ESRI 2020; FEMA 2022
3.6-3	Permitted Outfalls	ESRI 2020
3.6-4	Average Discharge Temperatures	
3.6-5	Average Intake Temperatures	
3.6-6	Underdrain System Map	ESRI 2020
3.6-7	Onsite Groundwater Wells	ESRI 2020
3.6-8	April 2020 Potentiometric Map	ESRI 2020
3.6-9	Off-Site Registered Water Wells within 2-Miles of PNPP	ESRI 2020; ODNR 2022b
3.7-1	NWI Wetlands 6-Mile Radius	ESRI 2020; USCB 2022a; USFWS 2022
3.7-2	NWI Wetlands Onsite Map	ESRI 2020; USFWS 2022

No.	Title	References
3.8-1	Historical Ohio Topography Map 1868	HMW 2022
3.8-2	USGS 1904 and 1905 Topography Map	USGS 2022d
3.8-3	Unrestricted NRHP Properties and Cemeteries within 6-Miles of PNPP	USDA 2022a
3.8-4 through 3.8-10	Historical Photos of Plant Construction	
3.11-1 through 3.11-14	EJ Figures Minority Populations	USCB 2022a; USCB 2022b; USGS 2021a
3.11-15 through 3.11-18	EJ Figures Low-Income Populations	USCB 2022a; USCB 2022c; USGS 2021a

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Attachment A: NRC NEPA Issues for License Renewal

NRC NEPA Issues for License Renewal of Nuclear Power Plants

Perry Nuclear Power Plant Unit 1 Environmental Report

NRC NEPA Issues for License Renewal of Nuclear Power Plants

Energy Harbor has prepared this environmental report in accordance with the requirements of U.S. Nuclear Regulatory Commission (NRC) regulation 10 CFR 51.53. The NRC included in the regulation the list of 78 National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants that were identified in the 2013 GEIS (Appendix B to Subpart A of 10 CFR Part 51, Table B-1).

The following table lists the 78 issues from 10 CFR Part 51, Appendix B, Table B-1, and identifies the section in this environmental report in which Energy Harbor addresses each issue.

Table A-1. Perry Nuclear Power Plant Environmental Report Cross-Reference of License Renewal NEPA Issues

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	Land Use			
1	Onsite land use	1	4.1	4.2.1.1/4-6
2	Offsite land use	1	4.1	4.2.1.1/4-7
3	Offsite land use in transmission line rights-of-way	1	4.0.1	4.2.1.1/4-6
	Visual Resources			
4	Aesthetic impacts	1	4.1	4.2.1.2/4-9
	Air Quality			
5	Air quality (all plants)	1	4.2	4.3.1.1/4-14
6	Air quality effects of transmission lines	1	4.2	4.3.1.1/4-14
	Noise			
7	Noise impacts	1	4.3	4.3.1.2/4-19
	Geologic Impacts			
8	Geology and soils	1	4.4	4.4/4-29
	Surface Water Resources			
9	Surface water use and quality (non-cooling system impacts)	1	4.5	4.5.1.1/4-30
10	Altered current patterns at intake and discharge structures	1	4.5	4.5.1.1/4-36
11	Altered salinity gradients	1	4.0.1	4.5.1.1/4-36
12	Altered thermal stratification of lakes	1	4.5	4.5.1.1/4-37
13	Scouring caused by discharged cooling water	1	4.5	4.5.1.1/4-38
14	Discharge of metals in cooling system effluent	1	4.5	4.5.1.1/4-38
15	Discharge of biocides, sanitary wastes, and minor chemical spills	1	4.5	4.5.1.1/4-39
16	Surface water use conflicts (plants with once-through cooling systems)	1	4.0.1	4.5.1.1/4-40
17	Surface water use conflicts (plants with cooling ponds, or cooling towers using makeup water from a river)	2	4.5.1	4.5.1.1/4-41
18	Effects of dredging on surface water quality	1	4.0.1	4.5.1.1/4-42
19	Temperature effects on sediment transport capacity	1	4.5	4.5.1.1/4-43
	Groundwater Resources			
20	Groundwater contamination and use	1	4.5	4.5.1.2/4-45

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	(non-cooling system impacts)			
21	Groundwater use conflicts (plants that withdraw <100 gpm)	1	4.5	4.5.1.2/4-47
22	Groundwater use conflicts (plants that withdraw >100 gpm)	2	4.5.3	4.5.1.2/4-48
23	Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	2	4.5.2	4.5.1.2/4-48
24	Groundwater quality degradation resulting from water withdrawals	1	4.5	4.5.1.2/4-49
25	Groundwater quality degradation (plants with cooling ponds in salt marshes)	1	4.0.1	4.5.1.2/4-50
26	Groundwater quality degradation (plants with cooling ponds at inland sites)	2	4.5.4	4.5.1.2/4-51
27	Radionuclides released to groundwater	2	4.5.5	4.5.1.2/4-51
	Terrestrial Resources			
28	Effects on terrestrial resources (non-cooling system impacts)	2	4.6.5	4.6.1.1/4-59
29	Exposure of terrestrial organism to radionuclides	1	4.6	4.6.1.1/4-61
30	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	1	4.0.1	4.6.1.1/4-64
31	Cooling tower impacts on vegetation (plants with cooling towers)	1	4.6	4.6.1.1/4-69
32	Bird collisions with plant structures and transmission lines	1	4.6	4.6.1.1/4-70
33	Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.4	4.6.1.1/4-75
34	Transmission line ROW management impacts on terrestrial resources	1	4.6	4.6.1.1/4-75
35	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.6	4.6.1.1/4-80
	Aquatic Resources			
36	Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.1	4.6.1.2/4-87
37	Impingement and entrainment of aquatic organisms (plants with cooling towers)	1	4.6	4.6.1.2/4-92

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
38	Entrainment of phytoplankton and zooplankton (all plants)	1	4.6	4.6.1.2/4-93
39	Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.2	4.6.1.2/4-94
40	Thermal impacts on aquatic organisms (plants with cooling towers)	1	4.6	4.6.1.2/4-96
41	Infrequently reported thermal impacts (all plants)	1	4.6	4.6.1.2/4-97
42	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	1	4.6	4.6.1.2/4-100
43	Effects of non-radiological contaminants on aquatic organisms	1	4.6	4.6.1.2/4-103
44	Exposure of aquatic organisms to radionuclides	1	4.6	4.6.1.2/4-105
45	Effect of dredging on aquatic organisms	1	4.0.1	4.6.1.2/4-107
46	Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.3	4.6.1.2/4-109
47	Effects on aquatic resources (non-cooling system impacts)	1	4.6	4.6.1.2/4-110
48	Impacts of transmission line ROW management on aquatic resources	1	4.6	4.6.1.2/4-112
49	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses	1	4.6	4.6.1.2/4-110
	Special Status Species and Habitats			
50	Threatened, endangered, and protected species and essential fish habitat	2	4.6.6	4.6.1.3/4-115
	Historic and Cultural Resources			
51	Historic and cultural resources	2	4.7	4.7.1/4-122
	Socioeconomics			
52	Employment and income, recreation and tourism	1	4.8	4.8.1.1/4-127
53	Tax revenues	1	4.8	4.8.1.1/4-128
54	Community services and education	1	4.8	4.8.1.1/4-129
55	Population and housing	1	4.8	4.8.1.1/4-130
56	Transportation	1	4.8	4.8.1.1/4-131
	Human Health			
57	Radiation exposures to the public	1	4.9	4.9.1.1.1/4-140
58	Radiation exposures to plant workers	1	4.9	4.9.1.1.1/4-136

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
59	Human health impacts from chemicals	1	4.9	4.9.1.1.2/4-147
60	Microbiological hazards to the public (plants that use cooling ponds, lake, or canals or that discharge to a river)	2	4.9.1	4.9.1.1.3/4-149
61	Microbiological hazards to plant workers	1	4.9	4.9.1.1.3/4-149
62	Chronic effects of electromagnetic fields	UC	4.0.3	4.9.1.1.4/4-150
63	Physical occupational hazards	1	4.9	4.9.1.1.5/4-156
64	Electric shock hazards	2	4.9.2	4.9.1.1.5/4-156
	Postulated Accidents			
65	Design-basis accidents	1	4.15.1	4.9.1.2/4-158
66	Severe accidents	2	4.15.2	4.9.1.2/4-158
	Environmental Justice			
67	Minority and low-income populations	2	4.10.1	4.10.1/4-167
	Waste Management			
68	Low-level waste storage and disposal	1	4.11	4.11.1.1/4-171
69	Onsite storage of spent nuclear fuel	1	4.11	4.11.1.2/4-172
70	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	1	4.11	4.11.1.3/4-175
71	Mixed waste storage and disposal	1	4.11	4.11.1.4/4-178
72	Non-radioactive waste storage and disposal	1	4.11	4.11.1.5/4-179
	Cumulative Impacts			
73	Cumulative impacts	2	4.12	4.13/4-243
	Uranium Fuel Cycle			
74	Offsite radiological impacts–individual impacts from other than the disposal of spent fuel and high-level waste	1	4.13	4.12.1.1/4-193
75	Offsite radiological impacts–collective impacts from other than the disposal of spent fuel and high-level waste	1	4.13	4.12.1.1/4-194
76	Non-radiological Impacts of the uranium fuel cycle	1	4.13	4.12.1.1/4-194
77	Transportation	1	4.13	4.12.1.1/4-196
	Termination of Nuclear Power Plant Operations and Decommissioning			
78	Termination of plant operations and decommissioning	1	4.14	4.12.2.1/4-201

a. 10 CFR 51, Subpart A, Appendix A, Table B-1 (issue numbers added to facilitate discussion).

b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437, Rev 1).

UC = uncategorized (categorization and impact finding definitions do not apply to the issue).

Attachment B: NPDES Permit

Application No. OH0063461

Modification Issue Date: October 6, 2020

Modification Effective Date: February 1, 2021

Expiration Date: February 28, 2023

Ohio Environmental Protection Agency
Authorization to Discharge Under the
National Pollutant Discharge Elimination System

In compliance with the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et. seq., hereinafter referred to as the "Act"), and the Ohio Water Pollution Control Act (Ohio Revised Code Section 6111),

Energy Harbor Nuclear Operating Company

is authorized by the Ohio Environmental Protection Agency, hereinafter referred to as "Ohio EPA," to discharge from the Perry Nuclear Power Plant wastewater treatment works located at 10 Center Road, North Perry Village, Ohio, Lake County and discharging to Lake Erie in accordance with the conditions specified in Parts I, II, III, IV, V, and VI of this permit.

In accordance with the antidegradation rule, OAC 3745-1-05, I have determined that a lowering of water quality in Lake Erie is necessary. Provision (D)(1)(g) was applied to this application. This provision excludes the need for the submittal and subsequent review of technical alternatives and social and economic issues related to the degradation. Other rule provisions, however, including public participation and appropriate intergovernmental coordination were required and considered prior to reaching this decision.

This permit is conditioned upon payment of applicable fees as required by Section 3745.11 of the Ohio Revised Code.

This permit and the authorization to discharge shall expire at midnight on the expiration date shown above. In order to receive authorization to discharge beyond the above date of expiration, the permittee shall submit such information and forms as are required by the Ohio EPA no later than 180 days prior to the above date of expiration.

Laurie A. Stevenson

Laurie A. Stevenson
Director

Total Pages: 55

Part I, A. - FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date of this permit modification and lasting until the expiration date, the permittee is authorized to discharge in accordance with the following limitations and monitoring requirements from outfall 3IB00016004. See Part II, OTHER REQUIREMENTS, for locations of effluent sampling.

Table - Final Outfall - 004 - Final

Effluent Characteristic	Discharge Limitations							Monitoring Requirements		
	Concentration Specified Units				Loading* kg/day					
Parameter	Maximum	Minimum	Weekly	Monthly	Daily	Weekly	Monthly	Measuring Frequency	Sampling Type	Monitoring Months
00011 - Water Temperature - F	-	-	-	-	-	-	-	1/Day	Continuous	All
00400 - pH - S.U.	9.0	6.5	-	-	-	-	-	2/Week	Grab	All
34044 - Oxidants, Total Residual - mg/l	0.05	-	-	-	-	-	-	When Disch.	Grab	All
50050 - Flow Rate - MGD	-	-	-	-	-	-	-	1/Day	Continuous	All
50060 - Chlorine, Total Residual - mg/l	0.2	-	-	-	-	-	-	When Disch.	Grab	All
50092 - Mercury, Total (Low Level) - ng/l	1700	-	-	7.0	0.57	-	0.0023	1/Quarter	Grab	Quarterly
78739 - Chlorination/Bromination Duration - Minutes	120	-	-	-	-	-	-	When Disch.	Total	All

Notes for Station Number 3IB00016004:

a. Loading limits based on a flow rate of 88.23 MGD.

b. The Total Residual Chlorine (TRC) and Total Residual Oxidants (TRO) limits are the maximum allowed at the outfall at any time. Analyses are to be performed by amperometric titration, Orion Residual Chlorine Electrode, or other approved methods during chlorination and/or bromination. The daily grab samples for the TRC and TRO shall represent the maximum concentration discharged during chlorination and/or bromination.

c. Measure TRO, TRC and Cl/Br duration on days when using treatment.

d. Grab sample for TRO and TRC will be taken during treatment event.

e. TRO reflects the use of bromine compounds. Bromine can be used separately or in combination with chlorine. These limits are effective when bromine is used. Discharge limitations for TRO may be met using a dehalogenating agent necessary to completely eliminate the residual.

f. Report TRO on days when bromine compounds are used with or without chlorine. On days when no bromine compounds are used, state this in the remarks section and LEAVE THE DATA AREA BLANK.

g. Report TRC on days when ONLY chlorine compounds are used (i.e. no bromine compounds. On days when bromine or a combination of bromine and chlorine is used, state this in the remarks section and LEAVE THE DATA AREA BLANK.

h. Sampling shall be performed when discharging. If NO DISCHARGE OCCURS DURING THE ENTIRE MONTH:

1) eDMR users should select the "No Discharge" check box on the data entry form and enter "No discharge during the month" in the Remarks Section. PIN the eDMR.
2) Permittees reporting on paper should report "AL" in the first column of the first day of the month on the 4500 Form. Sign the form.

i. See Part II, Item H.

j. Mercury - See Part II, Items I, P, Q, R, and S.

Part I, A. - FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

2. During the period beginning on the effective date of this permit modification and lasting until the expiration date, the permittee is authorized to discharge in accordance with the following limitations and monitoring requirements from outfall 3IB00016094. See Part II, OTHER REQUIREMENTS, for locations of effluent sampling.

* This is actually Outfall 3IB00016004 for Chlorination/Bromination of greater than 120 minutes per day.

Table - Ficticious Outfall/Station - 094 - Final

Effluent Characteristic	Discharge Limitations							Monitoring Requirements		
	Concentration Specified Units				Loading* kg/day					
Parameter	Maximum	Minimum	Weekly	Monthly	Daily	Weekly	Monthly	Measuring Frequency	Sampling Type	Monitoring Months
00011 - Water Temperature - F	-	-	-	-	-	-	-	1/Day	Continuous	All
00400 - pH - S.U.	9.0	6.5	-	-	-	-	-	2/Week	Grab	All
34044 - Oxidants, Total Residual - mg/l	0.01	-	-	-	-	-	-	When Disch.	Grab	All
50050 - Flow Rate - MGD	-	-	-	-	-	-	-	1/Day	Continuous	All
50060 - Chlorine, Total Residual - mg/l	0.038	-	-	-	-	-	-	When Disch.	Grab	All
50092 - Mercury, Total (Low Level) - ng/l	1700	-	-	7.0	0.57	-	0.0023	1/Quarter	Grab	Quarterly
78739 - Chlorination/Bromination Duration - Minutes	-	-	-	-	-	-	-	When Disch.	Total	All

Notes for Station Number 3IB00016094:

a. Loading limits based on a flow of 88.23 MGD.

b. The Total Residual Chlorine (TRC) and Total Residual Oxidants (TRO) limits are the maximum allowed at the outfall at any time. Analyses are to be performed by amperometric titration, Orion Residual Chlorine Electrode, or other approved methods during chlorination and/or bromination. The daily grab samples for the TRC and TRO shall represent the maximum concentration discharged during chlorination and/or bromination.

c. Measure TRO, TRC and Cl/Br duration on days when using treatment.

d. Grab sample for TRO and TRC will be taken during treatment event.

e. TRO reflects the use of bromine compounds. Bromine can be used separately or in combination with chlorine. These limits are effective when bromine is used. Discharge limitations for TRO may be met using a dehalogenating agent necessary to completely eliminate the residual.

f. Sampling shall be performed when discharging. If NO DISCHARGE OCCURS DURING THE ENTIRE MONTH:

1) eDMR users should select the "No Discharge" check box on the data entry form and enter "No discharge during the month" in the Remarks Section. PIN the eDMR.
2) Permittees reporting on paper should report "AL" in the first column of the first day of the month on the 4500 Form. Sign the form.

g. See Part II, Item H.

h. Mercury - See Part II, Items I, P, Q, R, and S.

Part I, A. - FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

3. During the period beginning on the effective date of this permit modification and lasting until the expiration date, the permittee is authorized to discharge in accordance with the following limitations and monitoring requirements from outfall 3IB00016005, 3IB00016006, and 3IB00016007. See Part II, OTHER REQUIREMENTS, for locations of effluent sampling.

NOTES for Station Number 3IB00016005, 3IB00016006, and 3IB00016007:

a. Storm Water Pollution Prevention Plan - See Part IV.

Part I, A. - FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

4. During the period beginning on the effective date of this permit modificationand lasting until expiration date, the permittee is authorized to discharge in accordance with the following limitations and monitoring requirements from outfall 3IB00016601. See Part II, OTHER REQUIREMENTS, for locations of effluent sampling.

Table - Internal Monitoring Station - 601 - Final

Effluent Characteristic	Discharge Limitations							Monitoring Requirements		
	Concentration Specified Units				Loading* kg/day					
Parameter	Maximum	Minimum	Weekly	Monthly	Daily	Weekly	Monthly	Measuring Frequency	Sampling Type	Monitoring Months
00400 - pH - S.U.	-	-	-	-	-	-	-	1 / 2 Weeks	Grab	All
00530 - Total Suspended Solids - mg/l	100	-	-	30	-	-	-	1 / 2 Weeks	Grab	All
00550 - Oil and Grease, Total - mg/l	20	-	-	15	-	-	-	1 / 2 Weeks	Grab	All
50050 - Flow Rate - MGD	-	-	-	-	-	-	-	Continuous	24hr Total	All

Notes for Station Number 3IB00016601:

a. Sampling shall be performed when discharging. If NO DISCHARGE OCCURS DURING THE ENTIRE MONTH:

1) eDMR users should select the "No Discharge" check box on the data entry form and enter "No discharge during the month" in the Remarks Section. PIN the eDMR.
2) Permittees reporting on paper should report "AL" in the first column of the first day of the month on the 4500 Form. Sign the form.

Part I, A. - FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

5. During the period beginning the third month from the effective date of this permit modification and lasting until expiration date, the permittee is authorized to discharge in accordance with the following limitations and monitoring requirements from outfall 3IB00016603. See Part II, OTHER REQUIREMENTS, for locations of effluent sampling.

Table - Internal Monitoring Station - 603 - Final

Effluent Characteristic	Discharge Limitations							Monitoring Requirements		
	Concentration Specified Units				Loading* kg/day					
Parameter	Maximum	Minimum	Weekly	Monthly	Daily	Weekly	Monthly	Measuring Frequency	Sampling Type	Monitoring Months
00400 - pH - S.U.	-	-	-	-	-	-	-	1 / 2 Weeks	Grab	All
00530 - Total Suspended Solids - mg/l	100	-	-	30	-	-	-	1 / 2 Weeks	Grab	All
00550 - Oil and Grease, Total - mg/l	20	-	-	15	-	-	-	1 / 2 Weeks	Grab	All
50050 - Flow Rate - MGD	-	-	-	-	-	-	-	1/Day	24hr Total	All
70300 - Residue, Total Filterable - mg/l	-	-	-	-	-	-	-	1/Quarter	Grab	Quarterly

Notes for Station Number 3IB00016603:

a. Sampling shall be performed when discharging. If NO DISCHARGE OCCURS DURING THE ENTIRE MONTH:

1) eDMR users should select the "No Discharge" check box on the data entry form and enter "No discharge during the month" in the Remarks Section. PIN the eDMR.
2) Permittees reporting on paper should report "AL" in the first column of the first day of the month on the 4500 Form. Sign the form.

Part I, B. - INFLUENT MONITORING REQUIREMENTS

1. Intake Monitoring. During the period beginning on the effective date and lasting until the expiration date, the permittee shall monitor the Intake at Station Number 3IB00016800, and report to the Ohio EPA in accordance with the following table. See Part II, OTHER REQUIREMENTS, for location of sampling.

Table - Influent Monitoring - 800 - Final

Effluent Characteristic	Discharge Limitations							Monitoring Requirements		
	Concentration Specified Units				Loading* kg/day					
Parameter	Maximum	Minimum	Weekly	Monthly	Daily	Weekly	Monthly	Measuring Frequency	Sampling Type	Monitoring Months
00011 - Water Temperature - F	-	-	-	-	-	-	-	1/Day	Continuous	All
00981 - Selenium, Total Recoverable - ug/l	-	-	-	-	-	-	-	1/Quarter	Grab	Quarterly
50050 - Flow Rate - MGD	-	-	-	-	-	-	-	1/Day	24hr Total Estimate	All
50092 - Mercury, Total (Low Level) - ng/l	-	-	-	-	-	-	-	1/Quarter	Grab	Quarterly

NOTES for Station Number 3IB00016800:

a. See Part II, Item K.

b. Mercury - See Part II, Item I.

Part II, OTHER REQUIREMENTS

A. Description of the location of the required sampling stations are as follows:

Sampling Station	Description of Location
3IB00016004	Final effluent at a point representative of the discharge from the discharge tunnel entrance structure. (Lat: 41N 48' 33"; Long: 81W 08' 50")
3IB00016094	Final effluent at a point representative of the discharge from the discharge tunnel entrance structure. This outfall is the same outfall as 3IB00016004 for chlorination/bromination more than 120 mins.
3IB00016005	Storm water discharge from the major stream impoundment. (Lat: 41N 47' 58"; Long: 81W 09' 17")
3IB00016006	Storm water discharge from the northwest storm drainage impoundment. (Lat: 41N 48' 05"; Long:81W 09' 05")
3IB00016007	Storm water discharge from the minor stream impoundment. (Lat: 41N 48' 21"; Long: 81W 08' 29")
3IB00016601	Internal monitoring station at a point representative of the discharge from the regenerant neutralization pits prior to entering outfall 004
3IB00016603	Internal monitoring station at a point representative of the discharge from the reverse osmosis system prior to entering outfall 004
3IB00016800	Influent monitoring station at inlet to the plant from Lake Erie

B. This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

1. Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
2. Controls any pollutant not limited in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

C. In the event that the permittee's operation requires the use of cooling or boiler water treatment additives that are discharged to surface waters of the state, written permission must be obtained from the director of the Ohio EPA prior to use. Discharges of these additives must meet Ohio Water Quality Standards and shall not be harmful or inimical to aquatic life. Reporting and testing requirements to apply for permission to use additives can be obtained from the Ohio EPA, Central Office, Division of Surface Water, Industrial Permits Unit. This information is also available on the DSW website:

http://www.epa.state.oh.us/portals/35/policy/01_22u2.pdf

D. There shall be no detectable amount of any priority pollutant attributable to cooling tower maintenance chemicals in the cooling tower blowdown wastewater.

E. Composite samples shall be comprised of a series of grab samples collected over a 24-hour period and proportionate in volume to the wastewater flow rate at the time of sampling. Such samples shall be collected at such times and locations, and in such a fashion, as to be representative of the facility's overall performance.

F. Grab samples shall be collected at such times and locations, and in such fashion, as to be representative of the facility's performance.

G. The parameters below have had effluent limitations established that are below the Ohio EPA Quantification Level (OEPA QL) for the approved analytical procedure promulgated at 40 CFR 136. OEPA QLs may be expressed as Practical Quantification Levels (PQL) or Minimum Levels (ML).

Compliance with an effluent limit that is below the OEPA QL is determined in accordance with ORC Section 6111.13 and OAC Rule 3745-33-07(C). For maximum effluent limits, any value reported below the OEPA QL shall be considered in compliance with the effluent limit. For average effluent limits, compliance shall be determined by taking the arithmetic mean of values reported for a specified averaging period, using zero (0) for any value reported at a concentration less than the OEPA QL, and comparing that mean to the appropriate average effluent limit. An arithmetic mean that is less than or equal to the average effluent limit shall be considered in compliance with that limit.

The permittee must utilize the lowest available detection method currently approved under 40 CFR Part 136 for monitoring these parameters.

REPORTING:

All analytical results, even those below the OEPA QL (listed below), shall be reported. Analytical results are to be reported as follows:

1. Results above the QL: Report the analytical result for the parameter of concern.

2. Results above the MDL, but below the QL: Report the analytical result, even though it is below the QL.

3. Results below the MDL: Analytical results below the method detection limit shall be reported as "below detection" using the reporting code "AA".

The following table of quantification levels will be used to determine compliance with NPDES permit limits:

Parameter	PQL	ML
Chlorine, total residual	0.050 mg/L	--
Oxidants, total residual	0.050 mg/L	--

This permit may be modified, or, alternatively, revoked and reissued, to include more stringent effluent limits or conditions if information generated as a result of the conditions of this permit indicate the presence of these pollutants in the discharge at levels above the water quality based effluent limit (WQBEL).

H. Sampling for common parameters at station 3IB00016004004, 3IB00016094 (when chlorination/brominationg for greater than 120 minutes per day), and 3IB00015800 shall occur the same day.

I. The permittee shall use EPA Method 1631 promulgated under 40 CFR 136 to comply with the influent and effluent mercury monitoring requirements of this permit.

J. There shall be no discharge of polychlorinated biphenyl compounds attributable to the permittee's operations.

K. Cooling Water Intake

1. The cooling water intake structure operated by the FirstEnergy Nuclear Power Plant has been evaluated using available information. At this time, Ohio EPA has determined that the cooling water intake structure represents the best technology available to minimize adverse environmental impact in accordance with Section 316(b) of the federal Clean Water Act (33 U.S.C. section 1326).

L. Cooling Water Intake Structure Monitoring Requirements

The permittee is required to perform the following monitoring to ensure that any technologies operated to comply with 40 CFR 125.94 are maintained and operated to function as designed including those installed to protect Federally-listed threatened or endangered species or designated critical habitat.

1. Visual or Remote Inspections

The permittee shall either conduct weekly visual inspections or employ remote monitoring devices during the period the cooling water intake structure is in operation. Inspections are not required for the off-shore intake crib.

M. Cooling Water Intake Structure Record Keeping and Reporting Requirements

1. Record Keeping Requirements

The permittee shall keep records of all the data used to complete the permit application and show compliance with the requirements of the 316(b) regulations until the subsequent permit is re-issued.

2. Reporting Requirements

The permittee shall submit an annual certification statement signed by the responsible corporate officer indicating whether there have been any substantial modifications of any units that impact the cooling water withdrawals and a summary of those changes. In addition, revisions must be submitted to the information required at 40 CFR 122.21(r) during the next permit application when new information is available.

N. Endangered Species Act

Nothing in this permit authorizes the take of threatened or endangered species of fish and wildlife.

O. The following non-storm water discharges may be authorized by this permit provided the non-storm water component of the discharge is in compliance with Part IV, Item C.10. of this permit: discharges from fire fighting activities; fire hydrant flushing; potable water sources including waterline flushings; irrigation drainage; drainage of non-treated lake water systems/ lawn watering/ routine external building washdown which does not use detergents; pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; springs; uncontaminated ground water; foundation or footing drains where flows are not contaminated with process materials such as solvents; and discharge of non-treated lake water from cooling water systems while performing essential maintenance to assure efficient plant operation

P. General Mercury Variance

The permittee is granted a general mercury variance under the provisions of Rule 3745-01-38(J) of the Ohio Administrative Code. The Perry Nuclear Power Plant has demonstrated that the facility is currently unable to comply with the monthly average water quality based effluent limit of 1.3 ng/l without construction of expensive end-of-pipe controls more stringent than those required by sections 301(b) and 306 of the Clean Water Act. The Perry Nuclear Power Plant is currently able to achieve an annual average mercury concentration of 12 ng/l. For general mercury variance purposes, the annual average mercury effluent concentration is defined as the average of the most recent 12 months of effluent data.

One of the conditions of the general mercury variance is that the permittee make reasonable progress towards attaining the water quality based effluent limits for mercury (1.b, below). To accomplish this the permittee is required to implement a pollutant minimization program (PMP) for mercury. The elements of a PMP include: a control strategy to locate, identify and, where cost-effective, reduce levels of mercury that contribute to discharge levels; periodic monitoring of sources and the treatment system; and annual reporting of results.

The plan of study that was part of the permittee¿s application for coverage under the general mercury variance includes items associated with developing a control strategy and initial implementation of a PMP. Condition 1.d, below, requires the permittee to implement the plan of study. By implementing the plan of study and meeting other conditions of this NPDES permit, the permittee is taking actions consistent with a PMP for mercury.

1. As conditions of this variance, the permittee shall meet the following requirements:

a. The permittee shall comply with the effluent limitations for mercury at outfall 3IB00016004/3IB00016094 given in Part I, A of this permit.

b. The permittee shall make reasonable progress towards attaining the monthly average water quality based effluent limit for mercury by complying with the general mercury variance conditions included in this NPDES permit.

c. The permittee shall use EPA Method 1631 to comply with the influent and effluent mercury monitoring requirements of this permit.

d. The permittee shall implement the plan of study as included in the permittee's mercury variance application submitted on February 25, 2019, including the following summary of requirements:

i. Continued mercury sampling of final outfall 3IB00016004/3IB00016094 and raw water intake station 3IB00016800.

ii. Twice annual sampling of atmospheric deposition of mercury.

iii. Evaluation of treatment chemicals for the presence of mercury.

e. The permittee shall assess the impact of the mercury variance on public health, safety, and welfare by, as a minimum, monitoring for mercury in the facility's influent and effluent as required by this NPDES permit.

f. The permittee shall achieve an annual average mercury effluent concentration equal to or less than 12 ng/l.

g. On or prior to March 1 of each year, the permittee shall submit two copies of an annual PMP report to Ohio EPA, Division of Surface Water, NPDES Permit Unit, P.O. Box 1049, Columbus, OH, 43216-1049. The annual PMP report shall include:

i. All minimization program monitoring results for the year

ii. A list of potential sources of mercury

iii. A summary of all actions taken to meet the effluent limits for mercury

iv. Any updates of the control strategy, including actions planned to reduce the levels of mercury in the treatment plant's final effluent

The Ohio EPA Annual Mercury PMP Report and Appendices are available on the Division of Surface Water Permits Program Technical Assistance web page at http://www.epa.ohio.gov/dsw/permits/technical_assistance.aspx . Open the Mercury list.

h. Upon completion of the actions identified in the plan of study as required in Part II, Item P.1.d. of this permit or upon submittal of the permittee's NPDES permit renewal application, whichever comes first, the permittee shall submit to Ohio EPA's Northeast District Office a certification stating that all permit conditions imposed to implement the plan of study and the PMP have been satisfied and whether compliance with the monthly average water quality based effluent limit for mercury has been achieved and can be maintained. This certification shall be accompanied by the following:

i. All available mercury influent and effluent data for the most recent 12 month period.

ii. Data documenting all known significant sources of mercury and the steps that have been taken to reduce or eliminate those sources; and

iii. A determination of the lowest mercury concentration that currently available data indicate can be reliably achieved through implementation of the PMP.

2. Exceedance of annual average limit of 12 ng/l.

a. If at any time after the effective date of this permit modification, the permittee's annual average of 12 ng/l or after the Director's final approval of a variance renewal, whichever is earlier, the permittee's annual average mercury effluent concentration exceeds 12 ng/l, the permittee shall:

i. Notify Ohio EPA's Northeast District Office not later than 30 days from the date of the exceedance.

ii. Submit an individual variance application, if a variance is desired, not later than 6 months from the date of the exceedance; or

iii. Request a permit modification not later than 6 months from the date of the exceedance for a compliance schedule to attain compliance with the water quality based effluent limits for mercury.

b. If the permittee complies with either 2.a.ii or 2.a.iii, above, the general mercury variance conditions included in this NPDES permit will remain in effect until the date that the Director acts on the individual variance application or the date that the permit modification becomes effective.

c. If the permittee does not comply with either 2.a.ii or 2.a.iii, above, a monthly water-quality based effluent limit for mercury of 1.3 ng/l shall apply at outfall 3IB00016004/3IB00016094 beginning 6 months from the date of the exceedance.

3. The requirements of Part II, Item P.2 shall not apply if the permittee demonstrates to the satisfaction of the Director that the mercury concentration in the permittee's effluent exceeds 12 ng/l due primarily to the presence of mercury in the permittee's intake water.

Q. Permit Reopener for Mercury Variance Revisions

Ohio EPA may reopen and modify this permit at any time based upon Ohio EPA water quality standard revisions to the mercury variance granted in Part II, Item P of this permit.

R. Renewal of Mercury Variance

For renewal of the mercury variance authorized in this permit, the permittee shall include the following information with the submittal of the subsequent NPDES permit renewal application:

1. the certification described under Part II, Item P.1.h., and all information required under Part II, Item P.1.h.i. through Part II, Item P.1.h.iii;

2. a status report on the progress being made implementing the pollutant minimization program (PMP). This information may be included in the annual PMP report required under Part II, Item P.1.g;

3. a listing of the strategies and/or programs in the PMP which will be continued under the next renewal of this permit; and

4. a statement requesting the renewal of the mercury variance.

S. Mercury in the Intake Water

It is acknowledged that intake water from Lake Erie used in Perry Nuclear Power Plant's operation contains or is the source of the vast majority of mercury loadings that are ultimately discharged from this outfall and variations of ambient water quality in the intake water are beyond the control of permittee.

PART III - GENERAL CONDITIONS

1. DEFINITIONS

"Daily discharge" means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

"Average weekly" discharge limitation means the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharges" measured during a calendar week divided by the number of "daily discharges" measured during that week. Each of the following 7-day periods is defined as a calendar week: Week 1 is Days 1 - 7 of the month; Week 2 is Days 8 - 14; Week 3 is Days 15 - 21; and Week 4 is Days 22 - 28. If the "daily discharge" on days 29, 30 or 31 exceeds the "average weekly" discharge limitation, Ohio EPA may elect to evaluate the last 7 days of the month as Week 4 instead of Days 22 - 28. Compliance with fecal coliform bacteria or E coli bacteria limitations shall be determined using the geometric mean.

"Average monthly" discharge limitation means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month. Compliance with fecal coliform bacteria or E coli bacteria limitations shall be determined using the geometric mean.

"85 percent removal" means the arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days shall not exceed 15 percent of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period.

"Absolute Limitations" Compliance with limitations having descriptions of "shall not be less than," "nor greater than," "shall not exceed," "minimum," or "maximum" shall be determined from any single value for effluent samples and/or measurements collected.

"Net concentration" shall mean the difference between the concentration of a given substance in a sample taken of the discharge and the concentration of the same substances in a sample taken at the intake which supplies water to the given process. For the purpose of this definition, samples that are taken to determine the net concentration shall always be 24-hour composite samples made up of at least six increments taken at regular intervals throughout the plant day.

"Net Load" shall mean the difference between the load of a given substance as calculated from a sample taken of the discharge and the load of the same substance in a sample taken at the intake which supplies water to given process. For purposes of this definition, samples that are taken to determine the net loading shall always be 24-hour composite samples made up of at least six increments taken at regular intervals throughout the plant day.

"MGD" means million gallons per day.

"mg/l" means milligrams per liter.

"ug/l" means micrograms per liter.

"ng/l" means nanograms per liter.

"S.U." means standard pH unit.

"kg/day" means kilograms per day.

"Reporting Code" is a five digit number used by the Ohio EPA in processing reported data. The reporting code does not imply the type of analysis used nor the sampling techniques employed.

"Quarterly (1/Quarter) sampling frequency" means the sampling shall be done in the months of March, June, August, and December, unless specifically identified otherwise in the Effluent Limitations and Monitoring Requirements table.

"Yearly (1/Year) sampling frequency" means the sampling shall be done in the month of September, unless specifically identified otherwise in the effluent limitations and monitoring requirements table.

"Semi-annual (2/Year) sampling frequency" means the sampling shall be done during the months of June and December, unless specifically identified otherwise.

"Winter" shall be considered to be the period from November 1 through April 30.

"Bypass" means the intentional diversion of waste streams from any portion of the treatment facility.

"Summer" shall be considered to be the period from May 1 through October 31.

"Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

"Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

"Sewage sludge" means a solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works as defined in section 6111.01 of the Revised Code. "Sewage sludge" includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes. "Sewage sludge" does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator, grit and screenings generated during preliminary treatment of domestic sewage in a treatment works, animal manure, residue generated during treatment of animal manure, or domestic septage.

"Sewage sludge weight" means the weight of sewage sludge, in dry U.S. tons, including admixtures such as liming materials or bulking agents. Monitoring frequencies for sewage sludge parameters are based on the reported sludge weight generated in a calendar year (use the most recent calendar year data when the NPDES permit is up for renewal).

"Sewage sludge fee weight" means the weight of sewage sludge, in dry U.S. tons, excluding admixtures such as liming materials or bulking agents. Annual sewage sludge fees, as per section 3745.11(Y) of the Ohio Revised Code, are based on the reported sludge fee weight for the most recent calendar year.

2. GENERAL EFFLUENT LIMITATIONS

The effluent shall, at all times, be free of substances:

A. In amounts that will settle to form putrescent, or otherwise objectionable, sludge deposits; or that will adversely affect aquatic life or water fowl;

B. Of an oily, greasy, or surface-active nature, and of other floating debris, in amounts that will form noticeable accumulations of scum, foam or sheen;

C. In amounts that will alter the natural color or odor of the receiving water to such degree as to create a nuisance;

D. In amounts that either singly or in combination with other substances are toxic to human, animal, or aquatic life;

E. In amounts that are conducive to the growth of aquatic weeds or algae to the extent that such growths become inimical to more desirable forms of aquatic life, or create conditions that are unsightly, or constitute a nuisance in any other fashion;

F. In amounts that will impair designated instream or downstream water uses.

3. FACILITY OPERATION AND QUALITY CONTROL

All wastewater treatment works shall be operated in a manner consistent with the following:

A. At all times, the permittee shall maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee necessary to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with conditions of the permit.

B. The permittee shall effectively monitor the operation and efficiency of treatment and control facilities and the quantity and quality of the treated discharge.

C. Maintenance of wastewater treatment works that results in degradation of effluent quality shall be scheduled during non-critical water quality periods and shall be carried out in a manner approved by Ohio EPA as specified in the Paragraph in the PART III entitled, "UNAUTHORIZED DISCHARGES".

4. REPORTING

A. Monitoring data required by this permit shall be submitted monthly on Ohio EPA 4500 Discharge Monitoring Report (DMR) forms using the electronic DMR (e-DMR) internet application. e-DMR allows permitted facilities to enter, sign, and submit DMRs on the internet. e-DMR information is found on the following web page:

http://www.epa.ohio.gov/dsw/edmr/eDMR.aspx

Alternatively, if you are unable to use e-DMR due to a demonstrated hardship, monitoring data may be submitted on paper DMR forms provided by Ohio EPA. Monitoring data shall be typed on the forms. Please contact Ohio EPA, Division of Surface Water at (614) 644-2050 if you wish to receive paper DMR forms.

B. DMRs shall be signed by a facility's Responsible Official or a Delegated Responsible Official (i.e. a person delegated by the Responsible Official). The Responsible Official of a facility is defined as:

1. For corporations - a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation; or the manager of one or more manufacturing, production or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

2. For partnerships - a general partner;

3. For a sole proprietorship - the proprietor; or,

4. For a municipality, state or other public facility - a principal executive officer, a ranking elected official or other duly authorized employee.

For e-DMR, the person signing and submitting the DMR will need to obtain an eBusiness Center account and Personal Identification Number (PIN). Additionally, Delegated Responsible Officials must be delegated by the Responsible Official, either on-line using the eBusiness Center's delegation function, or on a paper delegation form provided by Ohio EPA. For more information on the PIN and delegation processes, please view the following web page:

http://epa.ohio.gov/dsw/edmr/eDMR.aspx

C. DMRs submitted using e-DMR shall be submitted to Ohio EPA by the 20th day of the month following the month-of-interest. DMRs submitted on paper must include the original signed DMR form and shall be mailed to Ohio EPA at the following address so that they are received no later than the 15th day of the month following the month-of-interest:

Ohio Environmental Protection Agency
Lazarus Government Center
Division of Surface Water - PCU
P.O. Box 1049
Columbus, Ohio 43216-1049

D. If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified in Section 5. SAMPLING AND ANALYTICAL METHODS, the results of such monitoring shall be included in the calculation and reporting of the values required in the reports specified above.

E. Analyses of pollutants not required by this permit, except as noted in the preceding paragraph, shall not be reported to the Ohio EPA, but records shall be retained as specified in Section 7. RECORDS RETENTION.

5. SAMPLING AND ANALYTICAL METHOD

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored flow. Test procedures for the analysis of pollutants shall conform to regulation 40 CFR 136, "Test Procedures For The Analysis of Pollutants" unless other test procedures have been specified in this permit. The permittee shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to insure accuracy of measurements.

6. RECORDING OF RESULTS

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

A. The exact place and date of sampling; (time of sampling not required on EPA 4500)

B. The person(s) who performed the sampling or measurements;

C. The date the analyses were performed on those samples;

D. The person(s) who performed the analyses;

E. The analytical techniques or methods used; and

F. The results of all analyses and measurements.

7. RECORDS RETENTION

The permittee shall retain all of the following records for the wastewater treatment works for a minimum of three years except those records that pertain to sewage sludge disposal, use, storage, or treatment, which shall be kept for a minimum of five years, including:

A. All sampling and analytical records (including internal sampling data not reported);

B. All original recordings for any continuous monitoring instrumentation;

C. All instrumentation, calibration and maintenance records;

D. All plant operation and maintenance records;

E. All reports required by this permit; and

F. Records of all data used to complete the application for this permit for a period of at least three years, or five years for sewage sludge, from the date of the sample, measurement, report, or application.

These periods will be extended during the course of any unresolved litigation, or when requested by the Regional Administrator or the Ohio EPA. The three year period, or five year period for sewage sludge, for retention of records shall start from the date of sample, measurement, report, or application.

8. AVAILABILITY OF REPORTS

Except for data determined by the Ohio EPA to be entitled to confidential status, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the appropriate district offices of the Ohio EPA. Both the Clean Water Act and Section 6111.05 Ohio Revised Code state that effluent data and receiving water quality data shall not be considered confidential.

9. DUTY TO PROVIDE INFORMATION

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking, and reissuing, or terminating the permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

10. RIGHT OF ENTRY

The permittee shall allow the Director or an authorized representative upon presentation of credentials and other documents as may be required by law to:

A. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit.

B. Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit.

C. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit.

D. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

11. UNAUTHORIZED DISCHARGES

A. Bypass Not Exceeding Limitations - The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 11.B and 11.C.

B. Notice

1. Anticipated Bypass - If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

2. Unanticipated Bypass - The permittee shall submit notice of an unanticipated bypass as required in paragraph 12.B (24 hour notice).

C. Prohibition of Bypass

1. Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:

a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

c. The permittee submitted notices as required under paragraph 11.B.

2. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph 11.C.1.

12. NONCOMPLIANCE NOTIFICATION

A. Exceedance of a Daily Maximum Discharge Limit

1. The permittee shall report noncompliance that is the result of any violation of a daily maximum discharge limit for any of the pollutants listed by the Director in the permit by e-mail or telephone within twenty-four (24) hours of discovery.

The permittee may report to the appropriate Ohio EPA district office e-mail account as follows (this method is preferred):

Southeast District Office:	sedo24hournpdes@epa.state.oh.us
Southwest District Office:	swdo24hournpdes@epa.state.oh.us
Northwest District Office:	nwdo24hournpdes@epa.state.oh.us
Northeast District Office:	nedo24hournpdes@epa.state.oh.us
Central District Office:	cdo24hournpdes@epa.state.oh.us
Central Office:	co24hournpdes@epa.state.oh.us

The permittee shall attach a noncompliance report to the e-mail. A noncompliance report form is available on the following web site under the Monitoring and Reporting - Non-Compliance Notification section:

http://epa.ohio.gov/dsw/permits/individuals.aspx

Or, the permittee may report to the appropriate Ohio EPA district office by telephone toll-free between 8:00 AM and 5:00 PM as follows:

Southeast District Office:	(800) 686-7330
Southwest District Office:	(800) 686-8930
Northwest District Office:	(800) 686-6930
Northeast District Office:	(800) 686-6330
Central District Office:	(800) 686-2330
Central Office:	(614) 644-2001

The permittee shall include the following information in the telephone noncompliance report:

a. The name of the permittee, and a contact name and telephone number;

b. The limit(s) that has been exceeded;

c. The extent of the exceedance(s);

d. The cause of the exceedance(s);

e. The period of the exceedance(s) including exact dates and times;

f. If uncorrected, the anticipated time the exceedance(s) is expected to continue; and,

g. Steps taken to reduce, eliminate or prevent occurrence of the exceedance(s).

B. Other Permit Violations

1. The permittee shall report noncompliance that is the result of any unanticipated bypass resulting in an exceedance of any effluent limit in the permit or any upset resulting in an exceedance of any effluent limit in the permit by e-mail or telephone within twenty-four (24) hours of discovery.

The permittee may report to the appropriate Ohio EPA district office e-mail account as follows (this method is preferred):

Southeast District Office:	sedo24hournpdes@epa.state.oh.us
Southwest District Office:	swdo24hournpdes@epa.state.oh.us
Northwest District Office:	nwdo24hournpdes@epa.state.oh.us
Northeast District Office:	nedo24hournpdes@epa.state.oh.us
Central District Office:	cdo24hournpdes@epa.state.oh.us
Central Office:	co24hournpdes@epa.state.oh.us

The permittee shall attach a noncompliance report to the e-mail. A noncompliance report form is available on the following web site:

http://www.epa.ohio.gov/dsw/permits/permits.aspx

Or, the permittee may report to the appropriate Ohio EPA district office by telephone toll-free between 8:00 AM and 5:00 PM as follows:

Southeast District Office:	(800) 686-7330
Southwest District Office:	(800) 686-8930
Northwest District Office:	(800) 686-6930
Northeast District Office:	(800) 686-6330
Central District Office:	(800) 686-2330
Central Office:	(614) 644-2001

The permittee shall include the following information in the telephone noncompliance report:

a. The name of the permittee, and a contact name and telephone number;

b. The time(s) at which the discharge occurred, and was discovered;

c. The approximate amount and the characteristics of the discharge;

d. The stream(s) affected by the discharge;

e. The circumstances which created the discharge;

f. The name and telephone number of the person(s) who have knowledge of these circumstances;

g. What remedial steps are being taken; and,

h. The name and telephone number of the person(s) responsible for such remedial steps.

2. The permittee shall report noncompliance that is the result of any spill or discharge which may endanger human health or the environment within thirty (30) minutes of discovery by calling the 24-Hour Emergency Hotline toll-free at (800) 282-9378. The permittee shall also report the spill or discharge by e-mail or telephone within twenty-four (24) hours of discovery in accordance with B.1 above.

C. When the telephone option is used for the noncompliance reports required by A and B, the permittee shall submit to the appropriate Ohio EPA district office a confirmation letter and a completed noncompliance report within five (5) days of the discovery of the noncompliance. This follow up report is not necessary for the e-mail option which already includes a completed noncompliance report.

D. If the permittee is unable to meet any date for achieving an event, as specified in a schedule of compliance in their permit, the permittee shall submit a written report to the appropriate Ohio EPA district office within fourteen (14) days of becoming aware of such a situation. The report shall include the following:

1. The compliance event which has been or will be violated;

2. The cause of the violation;

3. The remedial action being taken;

4. The probable date by which compliance will occur; and,

5. The probability of complying with subsequent and final events as scheduled.

E. The permittee shall report all other instances of permit noncompliance not reported under paragraphs A or B of this section on their monthly DMR submission. The DMR shall contain comments that include the information listed in paragraphs A or B as appropriate.

F. If the permittee becomes aware that it failed to submit an application, or submitted incorrect information in an application or in any report to the director, it shall promptly submit such facts or information.

13. RESERVED

14. DUTY TO MITIGATE

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

15. AUTHORIZED DISCHARGES

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than, or at a level in excess of, that authorized by this permit shall constitute a violation of the terms and conditions of this permit. Such violations may result in the imposition of civil and/or criminal penalties as provided for in Section 309 of the Act and Ohio Revised Code Sections 6111.09 and 6111.99.

16. DISCHARGE CHANGES

The following changes must be reported to the appropriate Ohio EPA district office as soon as practicable:

A. For all treatment works, any significant change in character of the discharge which the permittee knows or has reason to believe has occurred or will occur which would constitute cause for modification or revocation and reissuance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. Notification of permit changes or anticipated noncompliance does not stay any permit condition.

B. For publicly owned treatment works:

1. Any proposed plant modification, addition, and/or expansion that will change the capacity or efficiency of the plant;

2. The addition of any new significant industrial discharge; and

3. Changes in the quantity or quality of the wastes from existing tributary industrial discharges which will result in significant new or increased discharges of pollutants.

C. For non-publicly owned treatment works, any proposed facility expansions, production increases, or process modifications, which will result in new, different, or increased discharges of pollutants.

Following this notice, modifications to the permit may be made to reflect any necessary changes in permit conditions, including any necessary effluent limitations for any pollutants not identified and limited herein. A determination will also be made as to whether a National Environmental Policy Act (NEPA) review will be required. Sections 6111.44 and 6111.45, Ohio Revised Code, require that plans for treatment works or improvements to such works be approved by the Director of the Ohio EPA prior to initiation of construction.

D. In addition to the reporting requirements under 40 CFR 122.41(l) and per 40 CFR 122.42(a), all existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Director as soon as they know or have reason to believe:

1. That any activity has occurred or will occur which would result in the discharge on a routine or frequent basis of any toxic pollutant which is not limited in the permit. If that discharge will exceed the highest of the "notification levels" specified in 40 CFR Sections 122.42(a)(1)(i) through 122.42(a)(1)(iv).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the "notification levels" specified in 122.42(a)(2)(i) through 122.42(a)(2)(iv).

17. TOXIC POLLUTANTS

The permittee shall comply with effluent standards or prohibitions established under Section 307 (a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement. Following establishment of such standards or prohibitions, the Director shall modify this permit and so notify the permittee.

18. PERMIT MODIFICATION OR REVOCATION

A. After notice and opportunity for a hearing, this permit may be modified or revoked, by the Ohio EPA, in whole or in part during its term for cause including, but not limited to, the following:

1. Violation of any terms or conditions of this permit;

2. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

3. Change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

B. Pursuant to rule 3745-33-04, Ohio Administrative Code, the permittee may at any time apply to the Ohio EPA for modification of any part of this permit. The filing of a request by the permittee for a permit modification or revocation does not stay any permit condition. The application for modification should be received by the appropriate Ohio EPA district office at least ninety days before the date on which it is desired that the modification become effective. The application shall be made only on forms approved by the Ohio EPA.

19. TRANSFER OF OWNERSHIP OR CONTROL

This permit may be transferred or assigned and a new owner or successor can be authorized to discharge from this facility, provided the following requirements are met:

A. The permittee shall notify the succeeding owner or successor of the existence of this permit by a letter, a copy of which shall be forwarded to the appropriate Ohio EPA district office. The copy of that letter will serve as the permittee's notice to the Director of the proposed transfer. The copy of that letter shall be received by the appropriate Ohio EPA district office sixty (60) days prior to the proposed date of transfer;

B. A written agreement containing a specific date for transfer of permit responsibility and coverage between the current and new permittee (including acknowledgement that the existing permittee is liable for violations up to that date, and that the new permittee is liable for violations from that date on) shall be submitted to the appropriate Ohio EPA district office within sixty days after receipt by the district office of the copy of the letter from the permittee to the succeeding owner;

At anytime during the sixty (60) day period between notification of the proposed transfer and the effective date of the transfer, the Director may prevent the transfer if he concludes that such transfer will jeopardize compliance with the terms and conditions of the permit. If the Director does not prevent transfer, he will modify the permit to reflect the new owner.

20. OIL AND HAZARDOUS SUBSTANCE LIABILITY

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Clean Water Act.

21. SOLIDS DISPOSAL

Collected grit and screenings, and other solids other than sewage sludge, shall be disposed of in such a manner as to prevent entry of those wastes into waters of the state, and in accordance with all applicable laws and rules.

22. CONSTRUCTION AFFECTING NAVIGABLE WATERS

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any navigable waters.

23. CIVIL AND CRIMINAL LIABILITY

Except as exempted in the permit conditions on UNAUTHORIZED DISCHARGES or UPSETS, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

24. STATE LAWS AND REGULATIONS

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Clean Water Act.

25. PROPERTY RIGHTS

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations.

26. UPSET

The provisions of 40 CFR Section 122.41(n), relating to "Upset," are specifically incorporated herein by reference in their entirety. For definition of "upset," see Part III, Paragraph 1, DEFINITIONS.

27. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

28. SIGNATORY REQUIREMENTS

All applications submitted to the Director shall be signed and certified in accordance with the requirements of 40 CFR 122.22.

All reports submitted to the Director shall be signed and certified in accordance with the requirements of 40 CFR Section 122.22.

29. OTHER INFORMATION

A. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

B. ORC 6111.99 provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $25,000 per violation.

C. ORC 6111.99 states that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $25,000 per violation.

D. ORC 6111.99 provides that any person who violates Sections 6111.04, 6111.042, 6111.05, or division (A) of Section 6111.07 of the Revised Code shall be fined not more than $25,000 or imprisoned not more than one year, or both.

30. NEED TO HALT OR REDUCE ACTIVITY

40 CFR 122.41(c) states that it shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with conditions of this permit.

31. APPLICABLE FEDERAL RULES

All references to 40 CFR in this permit mean the version of 40 CFR which is effective as of the effective date of this permit.

32. AVAILABILITY OF PUBLIC SEWERS

Not withstanding the issuance or non-issuance of an NPDES permit to a semi-public disposal system, whenever the sewage system of a publicly owned treatment works becomes available and accessible, the permittee operating any semi-public disposal system shall abandon the semi-public disposal system and connect it into the publicly owned treatment works.

Part IV. Storm Water Control Measures and Pollution Prevention Programs

In Part IV and in Part VI, the term "minimize" means reduce and/or eliminate to the extent achievable using control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry practice.

A. Control Measures.

You shall select, design, install, and implement control measures (including best management practices) to address the selection and design considerations in Part IV.B, and meet the control measures/best management practices in Part IV.C and any applicable numeric effluent limits in Part I. The selection, design, installation, and implementation of these control measures shall be in accordance with good engineering practices and manufacturer's specifications. Note that you may deviate from such manufacturer's specifications where you provide justification for such deviation and include documentation of your rationale in the part of your SWPPP that describes your control measures, consistent with Part IV.J.3. If you find that your control measures are not achieving their intended effect of minimizing pollutant discharges, you shall modify these control measures as expeditiously as practicable. Regulated storm water discharges from your facility include storm water run-on that commingles with storm water discharges associated with industrial activity at your facility.

B. Control Measure Selection and Design Considerations.

You shall consider the following when selecting and designing control measures:

1. Preventing storm water from coming into contact with polluting materials is generally more effective, and less costly, than trying to remove pollutants from storm water;
2. Using control measures in combination is more effective than using control measures in isolation for minimizing pollutants in your storm water discharge;
3. Assessing the type and quantity of pollutants, including their potential to impact receiving water quality, is critical to designing effective control measures that will achieve the limits in this permit;
4. Minimizing impervious areas at your facility and infiltrating runoff onsite (including bioretention cells, green roofs, and pervious pavement, among other approaches) can reduce runoff and improve groundwater recharge and stream base flows in local streams, although care shall be taken to avoid ground water contamination;
5. Attenuating flow using open vegetated swales and natural depressions can reduce in-stream impacts of erosive flows;
6. Conserving and/or restoring of riparian buffers will help protect streams from storm water runoff and improve water quality; and
7. Using treatment interceptors (e.g., swirl separators and sand filters) may be appropriate in some instances to minimize the discharge of pollutants.

C. Control Measures/Best Management Practices (BMPs)

1. Minimize Exposure. You shall minimize the exposure of manufacturing, processing, and material storage areas (including loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations) to rain, snow, snowmelt, and runoff by either locating these industrial materials and activities inside or protecting them with storm resistant coverings (although significant enlargement of impervious surface area is not recommended). In minimizing exposure, you should pay particular attention to the following:
    a. Use grading, berming, or curbing to prevent runoff of contaminated flows and divert run-on away from these areas;
    b. Locate materials, equipment, and activities so that leaks are contained in existing containment and diversion systems (confine the storage of leaky or leak-prone vehicles and equipment awaiting maintenance to protected areas);
    c. Clean up spills and leaks promptly using dry methods (e.g., absorbents) to prevent the discharge of pollutants;
    d. Use drip pans and absorbents under or around leaky vehicles and equipment or store indoors where feasible;
    e. Use spill/overflow protection equipment;
    f. Drain fluids from equipment and vehicles prior to on-site storage or disposal;
    g. Perform all cleaning operations indoors, under cover, or in bermed areas that prevent runoff and run-on and also that capture any overspray; and
    h. Ensure that all washwater drains to a proper collection system (i.e., not the storm water drainage system).

2. Good Housekeeping. You shall keep clean all exposed areas that are potential sources of pollutants, using such measures as sweeping at regular intervals, keeping materials orderly and labeled, and storing materials in appropriate containers.

3. Maintenance. You shall regularly inspect, test, maintain, and repair all industrial equipment and systems to avoid situations that may result in leaks, spills, and other releases of pollutants in storm water discharged to receiving waters. You shall maintain all control measures that are used to achieve the control measures/best management practices (BMPs) required by this permit in effective operating condition. Nonstructural control measures shall also be diligently maintained (e.g., spill response supplies available, personnel appropriately trained). If you find that your control measures need to be replaced or repaired, you shall make the necessary repairs or modifications as expeditiously as practicable.

4. Spill Prevention and Response Procedures. You shall minimize the potential for leaks, spills and other releases that may be exposed to storm water and develop plans for effective response to such spills if or when they occur. At a minimum, you shall implement:
    a. Procedures for plainly labeling containers (e.g., "Used Oil," "Spent Solvents," "Fertilizers and Pesticides," etc.) that could be susceptible to spillage or leakage to encourage proper handling and facilitate rapid response if spills or leaks occur;

b. Preventative measures such as barriers between material storage and traffic areas, secondary containment provisions, and procedures for material storage and handling;
c. Procedures for expeditiously stopping, containing, and cleaning up leaks, spills, and other releases. Employees who may cause, detect, or respond to a spill or leak shall be trained in these procedures and have necessary spill response equipment available. If possible, one of these individuals should be a member of your storm water pollution prevention team (Part V.D.1); and
d. Where a leak, spill or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, occurs during a 24-hour period, you shall notify the Ohio EPA in accordance with the requirements of Part III Item 12 of this permit.

5. Erosion and Sediment Controls. You shall stabilize exposed areas and contain runoff using structural and/or non-structural control measures to minimize onsite erosion and sedimentation, and the resulting discharge of pollutants. Among other actions you shall take to meet this limit, you shall place flow velocity dissipation devices at discharge locations and within outfall channels where necessary to reduce erosion and/or settle out pollutants. In selecting, designing, installing, and implementing appropriate control measures, you are encouraged to consult with the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation's Rainwater and Land Development manual (http://www.dnr.state.oh.us/tabid/9186/Default.aspx), U.S. EPA's internet-based resources relating to BMPs for erosion and sedimentation, including the sector-specific *Industrial Storm Water Fact Sheet Series*, (www.epa.gov/npdes/stormwater/msgp), *National Menu of Storm Water BMPs* (www.epa.gov/npdes/stormwater/menuofbmps), and *National Management Measures to Control Nonpoint Source Pollution from Urban Areas* (www.epa.gov/owow/nps/urbanmm/index.html).

6. Management of Runoff. You shall divert, infiltrate, reuse, contain, or otherwise reduce storm water runoff, to minimize pollutants in your discharges. In selecting, designing, installing, and implementing appropriate control measures, you are encouraged to consult with the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation's Rainwater and Land Development manual (http://www.dnr.state.oh.us/tabid/9186/Default.aspx), U.S. EPA's internet-based resources relating to runoff management, including the sector-specific *Industrial Storm Water Fact Sheet Series*, (www.epa.gov/npdes/stormwater/msgp), *National Menu of Storm Water BMPs* (www.epa.gov/npdes/stormwater/menuofbmps), and *National Management Measures to Control Nonpoint Source Pollution from Urban Areas* (www.epa.gov/owow/nps/urbanmm/index.html).

7. Salt Storage Piles or Piles Containing Salt. You shall enclose or cover storage piles of salt, or piles containing salt, used for deicing or other commercial or industrial purposes, including maintenance of paved surfaces. You shall implement appropriate measures (e.g., good housekeeping, diversions, containment) to minimize exposure resulting from adding to or removing materials from the pile.

8. Sector Specific Control Measures/Best Management Practices (BMPs). You shall achieve any additional control measures/best management practices (BMPs) stipulated in the relevant sector-specific section(s) of Part IV.K. of this permit.

9. Employee Training. You shall train all employees who work in areas where industrial materials or activities are exposed to storm water, or who are responsible for implementing activities necessary to meet the conditions of this permit (e.g., inspectors, maintenance personnel), including all members of your Pollution Prevention Team. Training shall cover both the specific control measures used to achieve the conditions in this Part, and monitoring, inspection, planning, reporting, and documentation requirements in other parts of this permit. Ohio EPA requires that training be conducted at least annually (or more often if employee turnover is high).

10. Non-Storm Water Discharges. You shall eliminate non-storm water discharges not authorized by an NPDES permit. The following are the non-storm water discharges authorized under this permit:
    a. Discharges from fire-fighting activities (not planned exercises);
    b. Fire hydrant flushings;
    c. Potable water, including water line flushings;
    d. Uncontaminated condensate from air conditioners, coolers, and other compressors and from the outside storage of refrigerated gases or liquids;
    e. Irrigation drainage;
    f. Landscape watering provided all pesticides, herbicides; and fertilizer have been applied in accordance with the approved labeling;
    g. Pavement wash waters where no detergents are used and no spills or leaks of toxic or hazardous materials have occurred (unless all spilled material has been removed);
    h. Routine external building washdown that does not use detergents;
    i. Uncontaminated ground water or spring water;
    j. Foundation or footing drains where flows are not contaminated with process materials; and
    k. Incidental windblown mist from cooling towers that collects on rooftops or adjacent portions of your facility, but not intentional discharges from the cooling tower (e.g., "piped" cooling tower blowdown or drains).

11. Waste, Garbage and Floatable Debris. You shall ensure that waste, garbage, and floatable debris are not discharged to receiving waters by keeping exposed areas free of such materials or by intercepting them before they are discharged.

12. Dust Generation and Vehicle Tracking of Industrial Materials. You shall minimize generation of dust and off-site tracking of raw, final, or waste materials.

D. Corrective Actions

1. Conditions Requiring Review and Revision to Eliminate Problem. If any of the following conditions occur, you shall review and revise the selection, design, installation, and implementation of your control measures to ensure that the condition is eliminated and will not be repeated in the future:
    a. An unauthorized release or discharge (e.g., spill, leak, or discharge of non-storm water not authorized by this or another NPDES permit) occurs at your facility;
    b. A discharge violates a numeric effluent limit;

c. You become aware, or Ohio EPA determines, that your control measures are not stringent enough for the discharge to meet applicable water quality standards;
d. An inspection or evaluation of your facility by an Ohio EPA official or local MS4 operator determines that modifications to the control measures are necessary to meet the control measures/best management practices (BMPs) in this permit; or
e. You find in your routine facility inspection, quarterly visual assessment, or comprehensive site inspection that your control measures are not being properly operated and maintained.

2. Conditions Requiring Review to Determine if Modifications Are Necessary. If any of the following conditions occur, you shall review the selection, design, installation, and implementation of your control measures to determine if modifications are necessary to meet the Part IV.A conditions in this permit:
   a. Construction or a change in design, operation, or maintenance at your facility significantly changes the nature of pollutants discharged in storm water from your facility, or significantly increases the quantity of pollutants discharged; or
   b. Sampling results exceeds an applicable benchmark.

3. Corrective Action Deadlines. You shall document your discovery of any of the conditions listed in Part IV.D.1 and Part IV.D.2 within 24 hours of making such discovery. Subsequently, within 30 days of such discovery, you shall document any corrective action(s) to be taken to eliminate or further investigate the deficiency, or if no corrective action is needed, the basis for that determination. Specific documentation required within 24 hours and 30 days is detailed in Part IV.D.4. If you determine that changes are necessary following your review, any modifications to your control measures shall be made before the next storm event if possible, or as soon as practicable following that storm event. These time intervals are not grace periods, but are schedules considered reasonable for documenting your findings and for making repairs and improvements. They are included in this permit to ensure that the conditions prompting the need for these repairs and improvements are not allowed to persist indefinitely.

4. Corrective Action Report. Within 24 hours of discovery of any condition listed in Part IV.D.1 and Part IV.D.2, you shall document the following information (i.e., questions 3-5 of the Corrective Actions section in the Annual Reporting Form, available at http://www.epa.state.oh.us/portals/35/permits/IndustrialStormWater_Final_GP_AppI_dec11.pdf):
   - Identification of the condition triggering the need for corrective action review;
   - Description of the problem identified; and
   - Date the problem was identified.

   Within 30 days of discovery of any condition listed in Part IV.D.1 and Part IV.D.2, you shall document the following information (i.e., questions 7-11 of the Corrective Actions section in the Annual Reporting Form):
   - Summary of corrective action taken or to be taken (or, for triggering events identified in Part IV.D.2 where you determine that corrective action is not necessary, the basis for this determination);
   - Notice of whether SWPPP modifications are required as a result of this discovery or corrective action;

- Date corrective action initiated; and
- Date corrective action completed or expected to be completed.

You shall include this documentation in an annual report as required in Part V. B..2 and retain onsite with your SWPPP.

5. Effect of Corrective Action. If the event triggering the review is a permit violation (e.g., non-compliance with an effluent limit), correcting it does not remove the original violation. Additionally, failing to take corrective action in accordance with this section is an additional permit violation. Ohio EPA will consider the appropriateness and promptness of corrective action in determining enforcement responses to permit violations.

6. Substantially Identical Outfalls. If the event triggering corrective action is linked to an outfall that represents other substantially identical outfalls, your review shall assess the need for corrective action for each outfall represented by the outfall that triggered the review. Any necessary changes to control measures that affect these other outfalls shall also be made before the next storm event if possible, or as soon as practicable following that storm event.

E. Inspections

Beginning on the effective date of this permit, you shall conduct the inspections in Part IV.E.1, Part IV.E.2, and Part IV.E.3 at your facility.

1. Routine Facility Inspections. Conduct routine facility inspections of all areas of the facility where industrial materials or activities are exposed to storm water, and of all storm water control measures used to comply with Part IV. Items A-C conditions contained in this permit. Routine facility inspections shall be conducted at least quarterly (i.e., once each calendar quarter) although in many instances, more frequent inspection (e.g., monthly) may be appropriate for some types of equipment, processes, and control measures or areas of the facility with significant activities and materials exposed to storm water. Perform these inspections during periods when the facility is in operation. You shall specify the relevant inspection schedules in your SWPPP document as required in Part IV. Items A-C. These routine inspections shall be performed by qualified personnel (for definition see VI - Definitions) with at least one member of your storm water pollution prevention team participating. At least once each calendar year, the routine facility inspection shall be conducted during a period when a storm water discharge is occurring.

   You shall document the findings of each routine facility inspection performed and maintain this documentation onsite with your SWPPP. You are not required to submit your routine facility inspection findings to Ohio EPA, unless specifically requested to do so. At a minimum, your documentation of each routine facility inspection shall include:

   a. The inspection date and time;
   b. The name(s) and signature(s) of the inspector(s);
   c. Weather information and a description of any discharges occurring at the time of the inspection;
   d. Any previously unidentified discharges of pollutants from the site;

e. Any control measures needing maintenance or repairs;
f. Any failed control measures that need replacement;
g. Any incidents of noncompliance observed; and
h. Any additional control measures needed to comply with the permit requirements.

Any corrective action required as a result of a routine facility inspection shall be performed consistent with Part IV.D of this permit.

2. Quarterly Visual Assessment of Storm Water Discharges. Once each calendar quarter for the entire permit term, you shall collect a storm water sample from each outfall that requires sampling under this permit and conduct a visual assessment of each of these samples. These samples are not required to be collected consistent with 40 CFR Part 136 procedures but should be collected in such a manner that the samples are representative of the storm water discharge. The visual assessment shall be made:
   - Of a sample in a clean, clear glass, or plastic container, and examined in a well-lit area;
   - On samples collected within the first 30 minutes of an actual discharge from a storm event. If it is not possible to collect the sample within the first 30 minutes of discharge, the sample shall be collected as soon as practicable after the first 30 minutes and you shall document why it was not possible to take samples within the first 30 minutes. In the case of snowmelt, samples shall be taken during a period with a measurable discharge from your site; and
   - For storm events, on discharges that occur at least 72 hours (3 days) from the previous discharge. The 72-hour (3-day) storm interval does not apply if you document that less than a 72-hour (3-day) interval is representative for local storm events during the sampling period. If it is not possible to collect the sample on discharges that occur at least 72 hours (3 days) from the previous discharge, the sample shall be collected as close to this storm interval as practicable and you shall document why it was not possible to take samples from a 72 hour (3 day) storm interval.
   - Areas Subject to Snow: In areas subject to snow, at least one quarterly visual assessment shall capture snowmelt discharge.
   - For the following water quality characteristics: color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution.

   You shall document the results of your visual assessments and maintain this documentation onsite with your SWPPP. You are not required to submit your visual assessment findings to Ohio EPA, unless specifically requested to do so. At a minimum, your documentation of the visual assessment shall include:
   - Sample location(s);
   - Sample collection date and time, and visual assessment date and time for each sample;
   - Personnel collecting the sample and performing visual assessment, and their signatures;
   - Nature of the discharge (i.e., runoff or snowmelt);
   - Results of observations of the storm water discharge;
   - Probable sources of any observed storm water contamination; and

- If applicable, why it was not possible to take samples within the first 30 minutes and/or from a 72 hour (3 day) storm interval.

Any corrective action required as a result of a quarterly visual assessment shall be performed consistent with Part IV.D of this permit.

The following are exceptions to quarterly visual assessments:

- Adverse Weather Conditions: When adverse weather conditions prevent the collection of samples during the quarter, you shall take a substitute sample during the next qualifying storm event. Documentation of the rationale for no visual assessment for the quarter shall be included with your SWPPP records. Adverse conditions are those that are dangerous or create inaccessibility for personnel, such as local flooding, high winds, or electrical storms, or situations that otherwise make sampling impractical, such as drought or extended frozen conditions.

- Inactive and unstaffed sites: The requirement for a quarterly visual assessment does not apply at a facility that is inactive and unstaffed, as long as there are no industrial materials or activities exposed to storm water. To invoke this exception, you shall maintain a statement in your SWPPP indicating that the site is inactive and unstaffed, and that there are no industrial materials or activities exposed to precipitation, in accordance with the substantive requirements in 40 CFR 122.26(g)(4)(iii). The statement shall be signed and certified in accordance with Part III.28 of this permit. If circumstances change and industrial materials or activities become exposed to storm water or your facility becomes active and/or staffed, this exception no longer applies and you shall immediately resume quarterly visual assessments. If you are not qualified for this exception at the time you are authorized under this permit, but during the permit term you become qualified because your facility is inactive and unstaffed, and there are no industrial materials or activities that are exposed to storm water, then you shall include the same signed and certified statement as above and retain it with your records.

3. Comprehensive Site Inspections. You shall conduct annual comprehensive site inspections while you are covered under this permit. The annual period to conduct the comprehensive site inspections begins on the date Ohio EPA has granted your authorization to discharge under this permit. Should your coverage be administratively continued after the expiration date of this permit, you shall continue to perform these inspections annually until you are no longer covered. Comprehensive site inspections shall be conducted by qualified personnel with at least one member of your storm water pollution prevention team participating in the comprehensive site inspections. Your comprehensive site inspections shall cover all areas of the facility affected by the requirements in this permit, including the areas identified in the SWPPP as potential pollutant sources (see Part IV.J..2) where industrial materials or activities are exposed to storm water, any areas where control measures are used to comply with the conditions in Part IV. Items A-C, and areas where spills and leaks have occurred in the past 3 years. The inspections shall also include a review of monitoring data collected in accordance with Part V. A. Inspectors shall consider the results of the past year's visual and analytical monitoring when planning and conducting inspections. Inspectors shall examine the following:

- Industrial materials, residue, or trash that may have or could come into contact with storm water;
- Leaks or spills from industrial equipment, drums, tanks, and other containers;
- Offsite tracking of industrial or waste materials, or sediment where vehicles enter or exit the site;
- Tracking or blowing of raw, final, or waste materials from areas of no exposure to exposed areas; and
- Control measures needing replacement, maintenance, or repair.

Storm water control measures required by this permit shall be observed to ensure that they are functioning correctly. If discharge locations are inaccessible, nearby downstream locations shall be inspected. Your annual comprehensive site inspection may also be used as one of the routine inspections, as long as all components of both types of inspections are included.

You shall document the findings of each comprehensive site inspection and maintain this documentation onsite with your SWPPP. In addition, you shall include this documentation in an annual report as required in Part V.B.2. At a minimum, your documentation of the comprehensive site inspection shall include (see the Annual Reporting Form at http://www.epa.state.oh.us/portals/35/permits/IndustrialStormWater_Final_GP_AppI_dec11.pdf):

- The date of the inspection;
- The name(s) and title(s) of the personnel making the inspection;
- Findings from the examination of areas of your facility identified in Part IV.E.3;
- All observations relating to the implementation of your control measures including:
  - Previously unidentified discharges from the site;
  - Previously unidentified pollutants in existing discharges;
  - Evidence of, or the potential for, pollutants entering the drainage system;
  - Evidence of pollutants discharging to receiving waters at all facility outfall(s), and the condition of and around the outfall, including flow dissipation measures to prevent scouring, and
  - Additional control measures needed to address any conditions requiring corrective action identified during the inspection.
- Any required revisions to the SWPPP resulting from the inspection;
- Any incidents of noncompliance observed or a certification stating the facility is in compliance with this permit (if there is no noncompliance); and
- A statement signed and certified in accordance with Part III.28 of the permit.

Any corrective action required as a result of the comprehensive site inspection shall be performed consistent with Part IV.D of this permit.

F. Storm Water Pollution Prevention Plan (SWPPP)

A storm water pollution prevention plan (SWPPP) shall be developed to address each outfall that discharges to waters of the state that contains storm water associated with industrial activity. Storm water pollution prevention plans shall be prepared in accordance with good engineering practices. The SWPPP shall identify potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges associated with industrial activity from the facility. The SWPPP shall describe and ensure the implementation of practices which are to be used to reduce the pollutants in storm water discharges associated with industrial activity at the facility and to assure compliance with the terms and conditions of this permit. Facilities must implement the provisions of the storm water pollution prevention plan required under this part as a condition of this permit.

The SWPPP does not contain effluent limitations; the limitations are contained in Parts I and IV Items A-C of this permit. The SWPPP is intended to document the selection, design, and installation of control measures. As distinct from the SWPPP, the documentation requirements are intended to document the implementation (including inspection, maintenance, monitoring, and corrective action) of the permit requirements.

G. Deadlines for SWPPP Preparation and Compliance.

1. The plan for a storm water discharge associated with industrial activity:

    a. Shall be prepared within six months of the effective date of this permit (and updated based on facility or materials handling changes as specified in Part IV, Item I);

    b. Shall provide for implementation and compliance with the terms of the plan within twelve months of the effective date of this permit.

2. Upon showing of good cause, the Director may establish a later date for preparing and compliance with a plan for a storm water discharge associated with industrial activity.

H. Signature and Plan Review.

1. The plan shall be signed and dated in accordance with Part III, Item 28, and be retained on-site at the facility which generates the storm water discharge.

2. The permittee shall make plans immediately available upon request to the Ohio EPA Director, or authorized representative, or Regional Administrator of U.S. EPA, a local agency approving storm water management plans, or in the case of a storm water discharge associated with industrial activity which discharges through a municipal separate storm sewer system, to the operator of the municipal system.

3. The Director may notify the permittee at any time that the plan does not meet one or more of the minimum requirements of this Part. Within 30 days of such notification from the Director, the permittee shall make the required changes to the plan and shall submit to the Director a written certification that the requested changes have been made.

4. All storm water pollution prevention plans required under this permit are considered reports that shall be available to the public under Section 308(b) of the Act. Confidential Business

Information (CBI) may be withheld from the public, but may not be withheld from those staff cleared for CBI review within Ohio EPA. An interested party wishing a copy of a discharger's SWPPP will have to contact the Ohio EPA to obtain a copy.

I. Keeping SWPPP Current

The permittee shall modify the plan whenever necessary to address any of the triggering conditions for corrective action in Part IV.D and to ensure that they do not reoccur, or to reflect changes implemented when a review following the triggering conditions in Part IV.D.2 indicates that changes to your control measures are necessary to meet the control measures/best management practices (BMPs) in this permit. Changes to your SWPPP document shall be made in accordance with the corrective action deadlines in Part IV.D.3 and Part IV.D.4.

Amendments to the plan may be reviewed by Ohio EPA in the same manner as Part IV.H above.

J. Contents of SWPPP. The plan shall include, at a minimum, the following items:

1. Pollution Prevention Team. You shall identify the staff members (by name or title) that comprise the facility's storm water pollution prevention team as well as their individual responsibilities. Your storm water pollution prevention team is responsible for assisting the facility manager in developing and revising the facility's SWPPP as well as maintaining control measures and taking corrective actions where required. Each member of the storm water pollution prevention team shall have ready access to either an electronic or paper copy of applicable portions of this permit and your SWPPP.

2. Description of Potential Pollutant Sources. You shall document at your facility where industrial materials or activities are exposed to storm water and from which allowable non-storm water discharges are released. Industrial materials or activities, include, but are not limited to: material handling equipment or activities; industrial machinery; raw materials; industrial production and processes: and intermediate products, by-products, final product or waste product. For each area identified, the description shall include, at a minimum:

    a. Site Description. Your SWPPP shall include:

        i. A description of the industrial activities at your facility;
        ii. A general location map (e.g. U.S. Geologic Survey (USGS) quadrangle map) with enough detail to identify the location of your facility and all receiving waters for your storm water discharges.
        iii. A site map showing
        - The size of the property in acres;
        - The location and extent of significant structures and impervious surfaces;
        - Directions of storm water flow (use arrows);
        - Locations of all existing structural control measures;
        - Locations of all receiving waters in the immediate vicinity of your facility;

- Locations of all storm water conveyances including ditches, pipes and swales;
- Locations of potential pollutant sources identified under Part IV J. 2.b;
- Locations where significant spills or leaks identified under Part IV J. 2.b. have occurred;
- Locations of all storm water monitoring points;
- Locations of storm water inlets and outfalls, with a unique identification code for each outfall (e.g. Outfall 001, Outfall 002, etc), indicating any outfalls that are considered substantially identical to another outfall, and an approximate outline of the areas draining to each outfall;
- Municipal separate storm sewer systems, where your storm water discharges to them;
- Locations and descriptions of all non-storm water discharges identified under Part IV. C. 10;
- Locations of the following activities where such activities are exposed to precipitation
  - Fueling stations;
  - Vehicle and equipment maintenance and/or cleaning areas;
  - Loading/unloading areas;
  - Immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility;
  - Transfer areas for substances in bulk;
  - Machinery; and
- Locations and sources of run-on to your site from adjacent property that contains significant quantities of pollutants.

b. Inventory of Exposed Materials. This includes a list of industrial activities exposed to storm water (e.g., material storage; equipment fueling, maintenance, and cleaning; cutting steel beams). This also includes a list of the pollutant(s) or pollutant constituents (e.g, crankcase oil, zinc, sulfuric acid, and cleaning solvents) associated with each identified activity. The pollutant list shall include all significant materials that have been handled, treated, stored, or disposed, and that have been exposed to storm water in the three years prior to the data you prepare of amend your SWPPP.

c. Spills and Leaks. You shall document where potential spills and leaks could occur that could contribute pollutants to storm water discharges, and the corresponding outfall(s) that would be affected by such spills and leaks. You shall document all significant spills and leaks of oil or toxic or hazardous pollutants that actually occurred at exposed areas, or that drained to a storm water conveyance, in the three years prior to the date you prepare or amend your SWPPP. Note that significant spills and leaks include, but are not limited to, releases of oil or hazardous substances in excess of quantities that are reportable under CWA Section 311 (see 40 CFR 110.6 and 40 CFR 117.21) or Section 102 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 USC Section 9602. This permit does not relieve you of the reporting requirements of 40 CFR 110, 40 CFR 117, and 40 CFR 302 relating to spills or other releases of oil or hazardous substances.

d. Sampling Data. A summary of existing discharge sampling data describing pollutants in storm water discharges from the facility.

e. Non-Storm Water Discharges. You shall document that you have evaluated for the presence of non-storm water discharges and that all unauthorized discharges have been eliminated. Documentation of your evaluation shall include: 1) The date of any evaluation; 2) A description of the evaluation criteria used; 3) A list of the outfalls or onsite drainage points that were directly observed during the evaluation; 4) The different types of non-storm water discharge(s) and source locations; and 5) The action(s) taken, such as a list of control measures used to eliminate unauthorized discharge(s), if any were identified. For example, a floor drain was sealed, a sink drain was re-routed to sanitary, or an NPDES permit application was submitted for an unauthorized cooling water discharge.

f. Salt Storage. You shall document the location of any storage piles containing salt used for deicing or other commercial or industrial purposes.

3. Description of Control Measures. You shall document the location and type of control measures you have installed and implemented at your site to achieve the control measures/best management practices (BMPs) in Part IV.C, and where applicable, in Part IV.K. You shall describe how you addressed the control measure selection and design considerations in Part IV.B. This documentation shall describe how the control measures at your site address both the pollutant sources identified in Part IV.J.2 and any storm water run-on that commingles with any discharges covered under this permit.

4. Schedules and Procedures.

a. Pertaining to Control Measures used to Comply with the Control Measures/Best Management Practices (BMPs). The following shall be documented in your SWPPP:

i. Good Housekeeping (See Part IV.C.2) – A schedule for regular pickup and disposal of waste materials, along with routine inspections for leaks and conditions of drums, tanks and containers.

ii. Maintenance (See Part IV.C.3) – Preventative maintenance procedures, including regular inspections, testing, maintenance, and repair of all industrial equipment and systems, and control measures, to avoid situations that may result in leaks, spills, and other releases, and any back-up practices in place should a runoff event occur while a control measure is off-line;

iii. Spill Prevention and Response Procedures (See Part IV.C.4) – Procedures for preventing and responding to spills and leaks. You may reference the existence of other plans for Spill Prevention Control and Countermeasure (SPCC) developed for the facility under Section 311 of the CWA or BMP programs otherwise required by an NPDES permit for the facility, provided that you keep a copy of that other plan onsite and make it available for review consistent with Part V.B.4; and

iv. Employee Training (See Part IV.C.9) – A schedule for all types of necessary training.

b. Pertaining to Monitoring and Inspection. Where applicable, you shall document in your SWPPP your procedures for conducting analytical storm water monitoring. You shall document in your SWPPP your procedures for performing, as appropriate, the three types of inspections specified by this permit, including: 1) Routine facility inspections (See Part IV.E.1), 2) Quarterly visual assessment of storm water discharges (See Part IV.E.2), and 3) Comprehensive site inspections (See Part IV.E.3).

5. Documentation Requirements. You are required to keep inspection, monitoring, and certification records with your SWPPP that together keep your records complete and up-to-date, and demonstrate your full compliance with the conditions of this permit.

K. Sector-Specific Requirements

You shall comply with the following sector-specific requirements associated with your primary industrial activity and any co-located industrial activities, as defined in Part VI. The sector-specific requirements apply to those areas of your facility where those sector-specific activities occur. These sector-specific requirements are in addition to any requirements specified elsewhere in this permit.

1. Limitations on Coverage.

a. *Prohibition of Non-Storm Water Discharges.* Non-storm water discharges subject to effluent limitations guidelines are not covered by this permit.

b. *Prohibition of Storm Water Discharges.* Storm water discharges from the following are not covered by this permit:

i. ancillary facilities (e.g., fleet centers and substations) that are not contiguous to a stream electric power generating facility;

ii. gas turbine facilities (providing the facility is not a dual-fuel facility that includes a steam boiler), and combined-cycle facilities where no supplemental fuel oil is burned (and the facility is not a dual-fuel facility that includes a steam boiler); and

iii. cogeneration (combined heat and power) facilities utilizing a gas turbine.

2. Additional Control Measures/Best Management Practices (BMPs). The following good housekeeping measures are required in addition to Part IV.C.2:

a. *Fugitive Dust Emissions.* Minimize fugitive dust emissions from coal handling areas. To minimize the tracking of coal dust offsite, consider procedures such as installing specially designed tires or washing vehicles in a designated area before they leave the site and controlling the wash water.

b. *Delivery Vehicles.* Minimize contamination of storm water runoff from delivery vehicles arriving at the plant site. Consider procedures to inspect delivery vehicles arriving at the plant site and ensure overall integrity of the body or container and procedures to deal with leakage or spillage from vehicles or containers.

c. *Fuel Oil Unloading Areas.* Minimize contamination of precipitation or surface runoff from fuel oil unloading areas. Consider using containment curbs in unloading areas, having personnel familiar with spill prevention and response procedures present during deliveries to ensure that any leaks or spills are immediately contained and cleaned up, and using spill and overflow protection devices (e.g., drip pans, drip diapers, or other containment devices placed beneath fuel oil connectors to contain potential spillage during deliveries or from leaks at the connectors).

d. *Chemical Loading and Unloading.* Minimize contamination of precipitation or surface runoff from chemical loading and unloading areas. Consider using containment curbs at chemical loading and unloading areas to contain spills, having personnel familiar with spill prevention and response procedures present during deliveries to ensure that any leaks or spills are immediately contained and cleaned up, and loading and unloading in covered areas and storing chemicals indoors.

e. *Miscellaneous Loading and Unloading Areas.* Minimize contamination of precipitation or surface runoff from loading and unloading areas. Consider covering the loading area; grading, berming, or curbing around the loading area to divert run-on; locating the loading and unloading equipment and vehicles so that leaks are contained in existing containment and flow diversion systems; or equivalent procedures.

f. *Liquid Storage Tanks.* Minimize contamination of surface runoff from above-ground liquid storage tanks. Consider protective guards around tanks, containment curbs, spill and overflow protection, dry cleanup methods, or equivalent measures.

g. *Large Bulk Fuel Storage Tanks.* Minimize contamination of surface runoff from large bulk fuel storage tanks. Consider containment berms (or their equivalent). You shall also comply with applicable State and Federal laws, including Spill Prevention, Control and Countermeasure (SPCC) Plan requirements.

h. *Spill Reduction Measures.* Minimize the potential for an oil or chemical spill, or reference the appropriate part of your SPCC plan. Visually inspect as part of your routine facility inspection the structural integrity of all above-ground tanks, pipelines, pumps, and related equipment that may be exposed to storm water, and make any necessary repairs immediately.

i. *Oil-Bearing Equipment in Switchyards.* Minimize contamination of surface runoff from oilbearing equipment in switchyard areas. Consider using level grades and gravel surfaces to retard flows and limit the spread of spills, or collecting runoff in perimeter ditches.

j. *Residue-Hauling Vehicles.* Inspect all residue-hauling vehicles for proper covering over the load, adequate gate sealing, and overall integrity of the container body. Repair vehicles without load covering or adequate gate sealing, or with leaking containers or beds.

k. *Ash Loading Areas.* Reduce or control the tracking of ash and residue from ash loading areas. Clear the ash building floor and immediately adjacent roadways of spillage, debris, and excess water before departure of each loaded vehicle.

l. *Areas Adjacent to Disposal Ponds or Landfills.* Minimize contamination of surface runoff from areas adjacent to disposal ponds or landfills. Reduce ash residue that may be tracked on to access roads traveled by residue handling vehicles, and reduce ash residue on exit roads leading into and out of residue handling areas.

m. *Landfills, Scrap yards, Surface Impoundments, Open Dumps, General Refuse Sites.* Minimize the potential for contamination of runoff from these areas.

3. Additional SWPPP Requirements.

a. *Drainage Area Site Map.* (See also Part IV.J.2.a.) Document in your SWPPP the locations of any of the following activities or sources that may be exposed to precipitation or surface runoff: storage tanks, scrap yards, and general refuse areas; short- and long-term storage of general materials (including but not limited to supplies, construction materials, paint equipment, oils, fuels, used and unused solvents, cleaning materials, paint, water treatment chemicals, fertilizer, and pesticides); landfills and construction sites; and stock pile areas (e.g., coal or limestone piles).

b. *Documentation of Good Housekeeping Measures.* You shall document in your SWPPP the good housekeeping measures implemented to meet the effluent limits in Part IV.K.2.

4. Additional Inspection Requirements.

a. *Comprehensive Site Compliance Inspection.* (See also Part IV.E.3.) As part of your inspection, inspect the following areas monthly: coal handling areas, loading or unloading areas, switchyards, fueling areas, bulk storage areas, ash handling areas, areas adjacent to disposal ponds and landfills, maintenance areas, liquid storage tanks, and long term and short term material storage areas.

Part V. Monitoring and Reporting Requirements

A. Reporting and Recordkeeping

1. Reporting Benchmark Monitoring Data to Ohio EPA. Benchmark monitoring data shall be submitted to Ohio EPA in accordance with Part III Item 4. of this permit.

2. Annual Report. You shall complete an annual report that includes the findings from your Part IV.E.3 comprehensive site inspection and any corrective action documentation as required in Part IV.D.4. If corrective action is not yet completed at the time of completion of this annual report, you shall describe the status of any outstanding corrective action(s). In addition to the information required in Part IV.D.4 (Corrective Action Report) and Part IV.E.3 (Comprehensive Site Inspection Documentation), you shall include the following information with your annual report:
   a. Facility name
   b. Ohio EPA Facility permit number
   c. Facility physical address
   d. Contact person name, title, and phone number

   You shall complete this report using the Annual Reporting Form provided by Ohio EPA at the following: http://www.epa.gov/npdes/pubs/msgp2008_appendixi.pdf. You shall keep the annual report with your SWPPP.

B. Storm Water Monitoring Requirements

1. Monitored Outfalls. Applicable benchmark monitoring requirements apply to each storm water outfall authorized by this permit, except as otherwise exempt from monitoring as a "substantially identical outfall."

2. Measurable Storm Event. All required monitoring shall be performed on a storm event that results in an actual discharge from your site ("measurable storm event") that follows the preceding measurable storm event by at least 72 hours (3 days). The 72-hour (3-day) storm interval does not apply if you are able to document that less than a 72-hour (3-day) interval is representative for local storm events during the sampling period. In the case of snowmelt, the monitoring shall be performed at a time when a measurable discharge occurs at your site.

   For each monitoring event, except snowmelt monitoring, you shall identify the date and duration (in hours) of the rainfall event, rainfall total (in inches) for that rainfall event, and time (in days) since the previous measurable storm event. For snowmelt monitoring, you shall identify the date of the sampling event.

3. Sample Type. You shall take a minimum of one grab sample from a discharge resulting from a measurable storm event as described in Part V.B.2. Samples shall be collected within the first 30 minutes of a measurable storm event. If it is not possible to collect the sample within the first 30 minutes of a measurable storm event, the sample shall be collected as soon as practicable after the first 30 minutes and documentation shall be kept with the SWPPP explaining why it was not possible to take samples within the first 30 minutes. In the case of snowmelt, samples shall be taken during a period with a measurable discharge.

4. Benchmark Monitoring. This permit stipulates pollutant benchmark concentrations that are applicable to your discharge three years after the effective date of the permit. The benchmark concentrations are not effluent limitations; a benchmark exceedance, therefore, is not a permit violation. Benchmark monitoring data are for your use to determine the overall effectiveness of your control measures and to assist you in knowing when additional corrective action(s) may be necessary to comply with the control measures/best management practices (BMPs) in Part IV. Items A-C.

   a. Based on the average of your last 4 quarterly monitoring results of the three-year benchmark evaluation period, if the monitoring values for any parameter exceeds the benchmark, you shall perform the following within one year of exceeding the benchmark:
      i. In accordance with Part IV.D.2, review the selection, design, installation, and implementation of your control measures to determine if modifications are necessary to meet the Part IV. Items A-C control measures/best management practices (BMPs) of this permit; or
      ii. Make a determination that no further pollutant reductions are technologically available and economically practicable and achievable in light of best industry practice to meet the control measures/best management practices (BMPs) in Part IV. Items A-C of this permit. You shall also document your rationale for concluding that no further pollutant reductions are achievable, and retain all records related to this documentation with your SWPPP. You shall also notify Ohio EPA of this determination in your next benchmark monitoring report.

   In accordance with Part IV.D.2, you shall review your control measures and perform any required corrective action immediately or document why no corrective action is required.

   b. If you determine that exceedance of the benchmark is attributable solely to the presence of that pollutant in the natural background, you are not required to perform corrective action provided that:
      i. The concentration of your benchmark monitoring result is less than or equal to the concentration of that pollutant in the natural background;
      ii. You document and maintain with your SWPPP your supporting rationale for concluding that benchmark exceedances are in fact attributable solely to natural

background levels. You shall include in your supporting rationale any data previously collected by you or others (including literature studies) that describe the levels of natural background pollutants in your storm water discharge.

Natural background pollutants include those substances that are naturally occurring in soils or groundwater. Natural background pollutants do not include legacy pollutants from earlier activity on your site, or pollutants in run-on from neighboring sources which are not naturally occurring.

c. *Exception for Inactive and Unstaffed Sites.* The requirement for benchmark monitoring does not apply at a facility that is inactive and unstaffed, as long as there are no industrial materials or activities exposed to storm water. To invoke this exception, you shall do the following:

i. Maintain a statement onsite with your SWPPP stating that the site is inactive and unstaffed, and that there are no industrial materials or activities exposed to storm water in accordance with the substantive requirements in 40 CFR 122.26(g) and sign and certify the statement in accordance with Part IV.E.2.

ii. If circumstances change and your facility becomes active and/or staffed, this exception no longer applies and you shall immediately begin complying with the applicable benchmark monitoring requirements under Part V. B; and

If you are not qualified for this exception at the time you are authorized under this permit, but during the permit term you become qualified because your facility is inactive and unstaffed, and there are no industrial materials or activities that are exposed to storm water, then you shall notify the appropriate district office of Ohio EPA of this change in your next benchmark monitoring report. You may discontinue benchmark monitoring once you have notified Ohio EPA, and prepared and signed the certification statement described above concerning your facility's qualification for this special exception.

Part VI. Definitions and Acronyms

Action Area – all areas to be affected directly or indirectly by the storm water discharges, allowable non-storm water discharges, and storm water discharge-related activities, and not merely the immediate area involved in these discharges and activities.

Best Management Practices (BMPs) – schedules of activities, practices (and prohibitions of practices), structures, vegetation, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to surface waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. See 40 CFR 122.2.

Co-located Industrial Activities – Any industrial activities, excluding your primary industrial activity(ies), located on-site that are defined by the storm water regulations at 122.26(b)(14)(i)-(ix) and (xi). An activity at a facility is not considered co-located if the activity, when considered separately, does not meet the description of a category of industrial activity covered by the storm water regulations or identified by the SIC code list in Appendix D.

Control Measure – refers to any BMP or other method (including effluent limitations) used to prevent or reduce the discharge of pollutants to surface waters of the State.

Director – the Director of the Ohio Environmental Protection Agency (Ohio EPA).

Discharge – when used without qualification, means the "discharge of a pollutant." See 40 CFR 122.2.

Discharge of a pollutant – any addition of any "pollutant" or combination of pollutants to "surface waters of the State" from any "point source," or any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. This includes additions of pollutants into surface waters of the State from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works. See 40 CFR 122.2.

Discharge-related activities – activities that cause, contribute to, or result in storm water and allowable non-storm water point source discharges, and measures such as the siting, construction and operation of BMPs to control, reduce, or prevent pollution in the discharges.

Drought-stricken area – a period of below average water content in streams, reservoirs, ground-water aquifers, lakes and soils.

U.S. EPA Approved or Established Total Maximum Daily Loads (TMDLs) – "U.S. EPA Approved TMDLs" are those that are developed by a State and approved by U.S. EPA. "U.S. EPA Established TMDLs" are those that are developed by U.S. EPA.

Existing Discharger – an operator applying for coverage under this permit for discharges authorized previously under an NPDES general or individual permit.

Facility or Activity – any NPDES "point source" (including land or appurtenances thereto) that is subject to regulation under the NPDES program. See 40 CFR 122.2.

Federal Facility – any buildings, installations, structures, land, public works, equipment, aircraft, vessels, and other vehicles and property, owned by, or constructed or manufactured for the purpose of leasing to, the federal government.

Illicit Discharge – is defined at 40 CFR 122.26(b)(2) and refers to any discharge to a municipal separate storm sewer that is not entirely composed of storm water, except discharges authorized under an NPDES permit (other than the NPDES permit for discharges from the MS4) and discharges resulting from fire fighting activities.

Impaired Water (or "Water Quality Impaired Water" or "Water Quality Limited Segment") – A water is impaired for purposes of this permit if it has been identified by a State or U.S. EPA pursuant to Section 303(d) of the Clean Water Act as not meeting applicable State water quality standards (these waters are called "water quality limited segments" under 40 CFR 30.2(j)). Impaired waters include both waters with approved or established TMDLs, and those for which a TMDL has not yet been approved or established.

Industrial Activity – the 10 categories of industrial activities included in the definition of "storm water discharges associated with industrial activity" as defined in 40 CFR 122.26(b)(14)(i)-(ix) and (xi).

Industrial Storm Water – storm water runoff from industrial activity.

Municipal Separate Storm Sewer – a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

(i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or a designated and approved management agency under section 208 of the CWA that discharges to surface waters of the State;

(ii) Designed or used for collecting or conveying storm water;

(iii) Which is not a combined sewer; and

(iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2. See 40 CFR 122.26(b)(4) and (b)(7).

New Discharger – a facility from which there is a discharge, that did not commence the discharge at a particular site prior to August 13, 1979, which is not a new source, and which has never received a finally effective NPDES permit for discharges at that site. See 40 CFR 122.2.

New Source – any building, structure, facility, or installation from which there is or may be a "discharge of pollutants," the construction of which commenced:

- after promulgation of standards of performance under section 306 of the CWA which are applicable to such source, or

- after proposal of standards of performance in accordance with section 306 of the CWA which are applicable to such source, but only if the standards are promulgated in accordance with section 306 within 120 days of their proposal. See 40 CFR 122.2.

New Source Performance Standards (NSPS) – technology-based standards for facilities that qualify as new sources under 40 CFR 122.2 and 40 CFR 122.29.

No exposure – all industrial materials or activities are protected by a storm-resistant shelter to prevent exposure to rain, snow, snowmelt, and/or runoff. See 40 CFR 122.26(g).

Ohio EPA – the Ohio Environmental Protection Agency.

Operator – any entity with a storm water discharge associated with industrial activity that meets either of the following two criteria:

(i) The entity has operational control over industrial activities, including the ability to modify those activities; or
(ii) The entity has day-to-day operational control of activities at a facility necessary to ensure compliance with the permit (e.g., the entity is authorized to direct workers at a facility to carry out activities required by the permit).

Person – an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof. See 40 CFR 122.2.

Point source – any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff. See 40 CFR 122.2.

Pollutant – dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal and agricultural waste discharged into water. See 40 CFR 122.2.

Pollutant of concern – A pollutant which causes or contributes to a violation of a water quality standard, including a pollutant which is identified as causing an impairment in a state's 303(d) list.

Primary industrial activity – includes any activities performed on-site which are (1) identified by the facility's primary SIC code; or (2) included in the narrative descriptions of 122.26(b)(14)(i), (iv), (v), or (vii), and (ix). [For co-located activities covered by multiple SIC codes, it is recommended that the primary industrial determination be based on the value of receipts or revenues or, if such information is not available for a particular facility, the number of employees or production rate for each process may be compared. The operation that generates the most revenue or employs the most personnel is the operation in which the facility is primarily engaged. In situations where the vast majority of on-site activity falls within one SIC code, that activity may be the primary industrial activity.] Narrative descriptions in 40 CFR 122.26(b)(14) identified above include: (i) activities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards; (iv) hazardous waste treatment storage, or disposal facilities including those that are operating under interim status or a permit under subtitle C of the Resource Conservation and Recovery Act (RCRA); (v) landfills, land application sites and open dumps that receive or have received industrial wastes; (vii) steam electric power generating facilities; and (ix) sewage treatment works with a design flow of 1.0 mgd or more.

Qualified Personnel – Qualified personnel are those who possess the knowledge and skills to assess conditions and activities that could impact storm water quality at your facility, and who can also evaluate the effectiveness of control measures.

Reportable Quantity Release – a release of a hazardous substance at or above the established legal threshold that requires emergency notification. Refer to 40 CFR Parts 110, 117, and 302 for complete definitions and reportable quantities for which notification is required.

Runoff coefficient – the fraction of total rainfall that will appear at the conveyance as runoff. See 40 CFR 122.26(b)(11).

Semi-Arid Climate – areas where annual rainfall averages from 10 to 20 inches.

Significant materials – includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under section 101(14) of CERCLA; any chemical the facility is required to report pursuant to section 313 of Title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with storm water discharges. See 40 CFR 122.26(b)(12).

Special Aquatic Sites – sites identified in 40 CFR 230 Subpart E. These are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region.

Storm Water – storm water runoff, snow melt runoff, and surface runoff and drainage. See 40 CFR 122.26(b)(13).

Storm Water Discharges Associated with Construction Activity – a discharge of pollutants in storm water runoff from areas where soil disturbing activities (e.g., clearing, grading, or excavating), construction materials, or equipment storage or maintenance (e.g., fill piles, borrow areas, concrete truck washout, fueling), or other industrial storm water directly related to the construction process (e.g., concrete or asphalt batch plants) are located. See 40 CFR 122.26(b)(14)(x) and 40 CFR 122.26(b)(15).

Storm Water Discharges Associated with Industrial Activity – the discharge from any conveyance that is used for collecting and conveying storm water and that is directly related to manufacturing, processing or raw materials storage areas at an industrial plant. The term does not include discharges from facilities or activities excluded from the NPDES program under Part 122. For the categories of industries identified in this section, the term includes, but is not limited to, storm water discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters (as defined at part 401 of this chapter); sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and final products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to storm water. For the purposes of this paragraph, material handling activities include storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, final product, by-product or waste product. The term excludes areas located on plant lands separate from the plant's industrial activities, such as office buildings and accompanying parking lots as long as the drainage from the excluded areas is not mixed with storm water drained from the above described areas. Industrial facilities include those that are federally, State, or municipally owned or operated that meet the description of the facilities listed in 40 CFR 122.26(b)(14).

Surface Waters of the State - Means all streams, lakes, ponds, marshes, watercourses, waterways, springs, irrigation systems, drainage systems, and all other bodies or accumulations of surface water, natural or artificial, which are situated wholly or partly within, or border upon, this state, or are within its jurisdiction, except those private waters which do not combine or effect a junction with natural surface waters.

Total Maximum Daily Loads (TMDLs) – A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. A TMDL includes wasteload allocations (WLAs) for point source discharges; load allocations (LAs) for nonpoint sources and/or natural background, and shall include a margin of safety (MOS) and account for seasonal variations. (See section 303(d) of the Clean Water Act and 40 CFR 130.2 and 130.7).

Water Quality Impaired – See 'Impaired Water'.

Water Quality Standards – A water quality standard defines the water quality goals of a water body, or portion thereof, by designating the use or uses to be made of the water and by setting criteria necessary to protect the uses. States and U.S. EPA adopt water quality standards to protect public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act (See CWA sections 101(a)2 and 303(c)). Water quality standards also include an antidegradation policy. See P.U.D. o. 1 of Jefferson County et al v. Wash Dept of Ecology et al, 511 US 701, 705 (1994).

"You" and "Your" – as used in this permit are intended to refer to the permittee, the operator, or the discharger as the context indicates and that party's facility or responsibilities. The use of "you" and "your" refers to a particular facility and not to all facilities operated by a particular entity. For example, "you shall submit" means the permittee shall submit something for that particular facility. Likewise, "all your discharges" would refer only to discharges at that one facility.

ABBREVIATIONS AND ACRONYMS

BAT – Best Available Technology Economically Achievable

BOD5 – Biochemical Oxygen Demand (5-day test)

BMP – Best Management Practice

BPJ – Best Professional Judgment

BPT – Best Practicable Control Technology Currently Available

CERCLA – Comprehensive Environmental Response, Compensation and Liability Act

CGP – Construction General Permit

COD – Chemical Oxygen Demand

CWA – Clean Water Act (or the Federal Water Pollution Control Act, 33 U.S.C. §1251 *et seq*)

CWT – Centralized Waste Treatment

DMR – Discharge Monitoring Report

U.S. EPA – U. S. Environmental Protection Agency

FWS – U. S. Fish and Wildlife Service

LA – Load Allocations

MDMR – MSGP Discharge Monitoring Report

MGD – Million Gallons per Day

MOS – Margin of Safety

MS4 – Municipal Separate Storm Sewer System

MSDS – Material Safety Data Sheet

MSGP – Multi-Sector General Permit

NAICS – North American Industry Classification System

NMFS – U. S. National Marine Fisheries Service

NOI – Notice of Intent

NOT – Notice of Termination

NPDES – National Pollutant Discharge Elimination System

NRC – National Response Center

NTU – Nephelometric Turbidity Unit

OMB – U. S. Office of Management and Budget

ORW – Outstanding Resource Water

OSM – U. S. Office of Surface Mining

POTW – Publicly Owned Treatment Works

RCRA – Resource Conservation and Recovery Act

RQ – Reportable Quantity

SARA – Superfund Amendments and Reauthorization Act

SIC – Standard Industrial Classification

SMCRA – Surface Mining Control and Reclamation Act

SPCC – Spill Prevention, Control, and Countermeasures

SWPPP – Storm Water Pollution Prevention Plan

TMDL – Total Maximum Daily Load

TSDF – Treatment, Storage, or Disposal Facility

TSS – Total Suspended Solids

USGS – United States Geological Survey

WLA – Wasteload Allocation

WQS – Water Quality Standard

ENTERED DIRECTOR'S JOURNAL

Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

RECEIVED
OHIO EPA
2017 JAN 30 AM 10: 17
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Certified Mail

Re: Perry Nuclear Power Plant 401 WQC for NPDES Permit
Permit - Intermediate Approval
401 Wetlands
Lake
DSW401154766

January 30, 2017

Mr. David P. Hamilton
FirstEnergy Nuclear Operating Company
76 South Main Street
Akron, OH 44308

Subject: Perry Nuclear Power Plant 401 WQC for NPDES Permit
Lake County / Perry Township
Grant of a Section 401 Water Quality Certification
Ohio EPA ID No. 154766
NRC Operating License No. NPF-58

Dear Stakeholders:

I hereby authorize the above referenced project under the following authorities and it is subject to the following modifications and/or conditions:

<u>Section 401 Water Quality Certification</u>
Pursuant to Section 401 of the Federal Water Pollution Control Act, Public Law 95-217, I hereby certify that the above-referenced project will comply with the applicable provisions of Sections 301, 302, 303, 306, and 307 of the Federal Water Pollution Control Act. This authorization is specifically limited to a Section 401 Water Quality Certification (here after referred to as "certification") with respect to water pollution and does not relieve the Certification Holder of further Certifications or Permits as may be necessary under the law. I have determined that a lowering of water quality in the Frontal Lake Erie tributaries watershed (HUC 04110003) as authorized by this certification is necessary. I have made this determination based upon the consideration of all public comments, if submitted, and the technical, social, and economic considerations concerning this application and its impact on waters of the state.

50 West Town Street • Suite 700 • P.O. Box 1049 • Columbus, OH 43216-1049
epa.ohio.gov • (614) 644-3020 • (614) 644-3184 (fax)

PART I ON-SITE WATER RESOURCES AND IMPACTS

A. Watershed Setting

The watershed in which this project is located, McKinley Creek – Frontal Lake Erie (HUC 04110003-02-04), has an area of 29.67 square miles of which 51.2 percent is developed, 25.7 percent is forest, 8.7 percent is grass/pasture, 13.9 percent is row crop agriculture, and 0.5 percent is other.

B. Project Description

This certification certifies that the project will not cause or contribute to state water quality standards in accordance with the issued individual National Pollutant Discharge Elimination System (NPDES) permit issued by Ohio EPA, permit number 3IB00016/OH0063461.

C. Impacts

Under this certification, no impact to waters of the state through the placement of fill or dredged material is authorized.

PART II TERMS & CONDITIONS

A. This certification shall remain valid and in effect so long as the federal Operating License issued by the Nuclear Regulatory Commission for this project is in effect.

B. A copy of this certification shall remain on-site for the duration of the project.

C. In the event of an inadvertent spill, the Certification Holder must immediately call the Ohio EPA Spill Hotline at 1-800-282-9378, as well as the Ohio EPA Section 401/Stormwater Manager (614-644-2001).

D. Unpermitted impacts to surface water resources and/or their buffers occurring as a result of this project must be reported within 24 hours of occurrence to Ohio EPA, Division of Surface Water, Section 401/Stormwater Manager (614-644-2001), for further evaluation.

E. Any authorized representative of the director shall be allowed to inspect the authorized activity at reasonable times to ensure that it is being or has been accomplished in accordance with the terms and conditions of this certification.

F. This proposal may require other permits from Ohio EPA. For information concerning application procedures, contact the Ohio EPA District Office as follows:

Ohio Environmental Protection Agency
Northeast District Office
2110 East Aurora Road
Twinsburg, Ohio 44087
330-963-1200

Additional information regarding environmental permitting assistance at Ohio EPA can be found at http://www.epa.ohio.gov/dir/permit_assistance.aspx

PART III NOTIFICATIONS TO OHIO EPA

All notifications, correspondence, and reports regarding this certification shall reference the following information:

Certification Holder Name: FirstEnergy Nuclear Operating Company
Project Name: Perry Nuclear Power Plant 401 WQC for NPDES Permit
Ohio EPA ID No.: 154766

and shall be sent to:

Ohio Environmental Protection Agency
Division of Surface Water, 401/IWP Unit
Lazarus Government Center
50 West Town Street
P.O. Box 1049
Columbus, Ohio 43216-1049

You are hereby notified that this action of the director is final and may be appealed to the Environmental Review Appeals Commission pursuant to Section 3745.04 of the Ohio Revised Code. The appeal must be in writing and set forth the action complained of and the grounds upon which the appeal is based. The appeal must be filed with the Commission within 30 days after notice of the director's action. The appeal must be accompanied by a filing fee of $70.00, made payable to "Ohio Treasurer Josh Mandel," which the Commission, in its discretion, may reduce if by affidavit you demonstrate that payment of the full amount of the fee would cause extreme hardship. Notice of the filing of the appeal shall be filed with the director within three days of filing with the Commission. Ohio EPA requests that a copy of the appeal be served upon the Ohio Attorney General's Office, Environmental Enforcement Section. An appeal may be filed with the Environmental Review Appeals Commission at the following address:

Environmental Review Appeals Commission
77 South High Street, 17th Floor
Columbus, Ohio 43215

Sincerely,

Craig W. Butler
Director

cc: Peter Swenson, U.S. EPA, Region 5
Dan Everson, U.S. Fish & Wildlife Service
John Kessler, ODNR, Office of Real Estate
Dave Snyder, Ohio Historical Preservation Office
Jeff DeShon, Ohio EPA, DSW, EAS
Bill Zawiski, Ohio EPA, NEDO, DSW
Kristin Susick, First Energy Nuclear Operating Company

Attachment: Site Location Map (project)

Ohio EPA has developed a customer service survey to get feedback from regulated entities that have contacted Ohio EPA for regulatory assistance, or worked with the Agency to obtain a permit, license or other authorization. Ohio EPA's goal is to provide our customers with the best possible customer service, and your feedback is important to us in meeting this goal. Please take a few minutes to complete this survey and share your experience with us at http://www.surveymonkey.com/s/ohioepacustomersurvey.

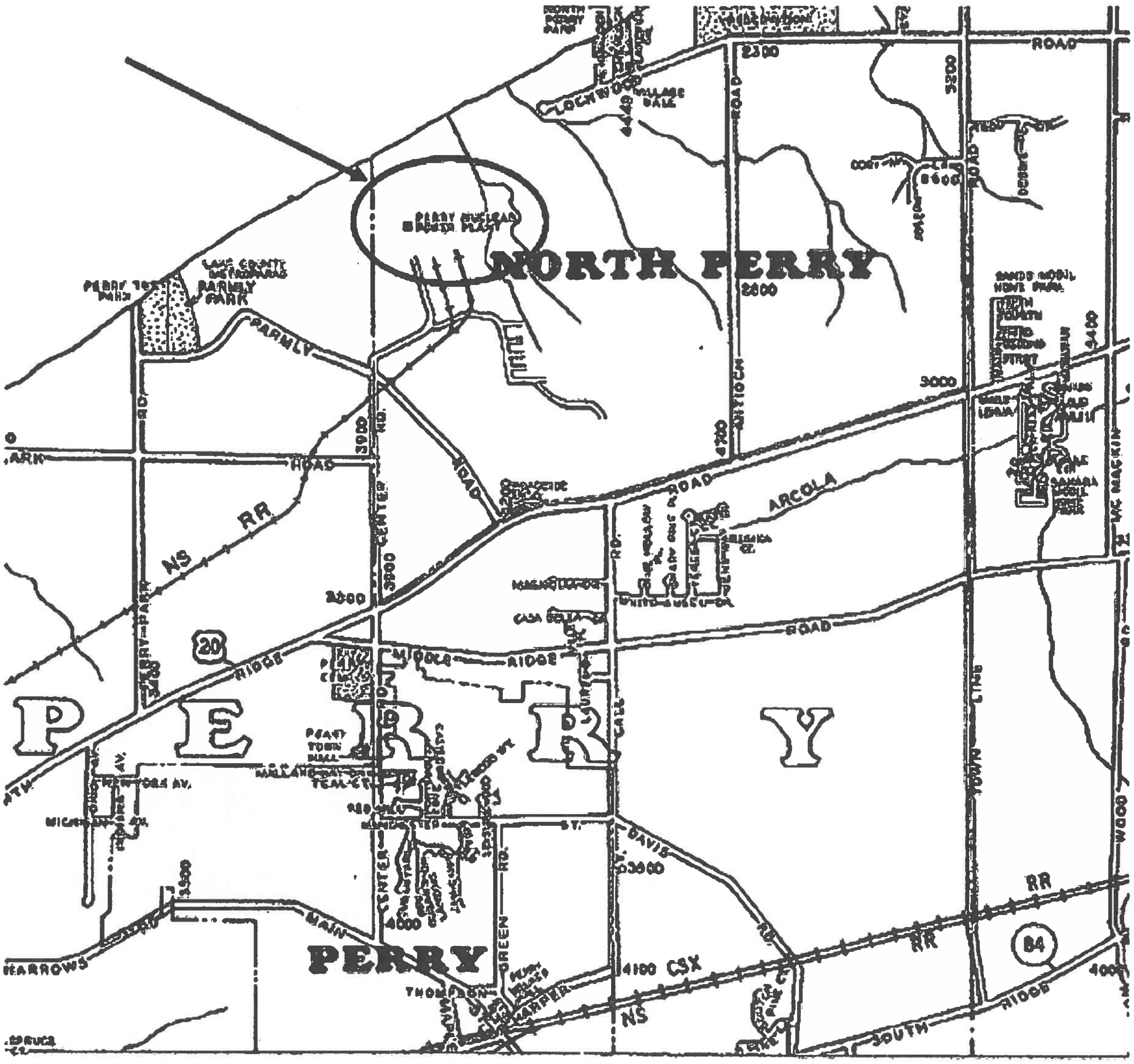


Figure 1 Site Location Map

Attachment C: Threatened and Endangered Species Consultation

Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

May 12, 2022
L-22-113

10 CFR 50.51

ATTN: Kendra Wecker
Chief, Division of Wildlife
Ohio Department of Natural Resources, Division of Wildlife
2045 Morse Road, Building G
Columbus, OH, 43229

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan

Dear Ms. Wecker,

Energy Harbor is preparing an application for renewing the operating license for Perry Nuclear Power Plant Unit 1 (PNPP) for an additional 20 years (see the table below). Energy Harbor is contacting you for assistance in assessing the impacts from continued operation during the license period.

PNPP Licensing Dates

PNPP Unit	Initial License Expiration Date	License Renewal Expiration Date
Unit 1	November 7, 2026	November 7, 2046

As part of the process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment to be undertaken to enable the continued operation of the unit. The ER addresses the potential to impact species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA), and important plant and animal habitats, including critical habitats as defined by the ESA and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

This letter seeks input from the Ohio Department of Natural Resources, Division of Wildlife (ODNR-DOW) regarding such effects in the vicinity of PNPP. Also, as part of the renewal process, the NRC may request consultation with your agency regarding the license renewal.

To facilitate our assessment and a smooth consultation by the NRC, we are contacting you early in the application process seeking input regarding the effects that license renewal activities may have on listed species (or candidates proposed for listing) and important plant habitats within the plant's environs and any questions or additional information necessary for the consultation process. Figures that depict the plant site boundary and the vicinity within a 6-mile radius of the plant, and a table of listed species in the plant's vicinity are attached. A brief discussion of the plant and its operations during the renewal period is provided below.

The PNPP is located in the village of North Perry in Lake County, Ohio. The site is situated on approximately 1,030 acres on the southern shores of Lake Erie. In accordance with the NRC regulations, the transmission lines within the scope of the license renewal are those located within the PNPP site boundary.

Species potentially occurring near the PNPP site, or within Lake County (the only county within a 6-mile radius of the site) that are currently federally, or state listed as threatened or endangered are included in the attached Table 1.

During the license renewal term, Energy Harbor proposes to continue operating the unit as currently operated. There are currently no ground-disturbing activities other than those to maintain existing structures and operations anticipated at the PNPP site during the license renewal period. Additionally, Energy Harbor does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process. Energy Harbor does not anticipate the continued operation of PNPP to adversely affect the environment or any cultural or historic resources.

As stated earlier, this letter seeks your input on the proposed continued operation of the PNPP regarding listed species and important habitats within the environs of the plant. We appreciate your notifying us of your comments and any information you believe Energy Harbor should consider in the preparation of the ER and ask that you confirm the list of threatened and endangered species presented in the attached Table 1. Your input is requested by 6/13/2022. Energy Harbor plans to include this letter and any response you provide in the final ER.

Should you or your staff have any questions or comments, please contact Ben Spiesman at (440) 477-1835 or via email at bspiesman@energyharbor.com

Sincerely,

Rod L. Penfield

Attachments:

1. Table 1. Threatened or Endangered Species potentially occurring near PNPP or within Lake County, Ohio
2. Figure 1 - PNPP Site
3. Figure 2 - PNPP 6-mile Vicinity

cc: T. Lentz
R. Turney-Work, Enercon Services
S. Burgess, Enercon Services

Attachment 1

L-22-113

Table 1 - Threatened or Endangered Species potentially occurring near PNPP or within Lake County, Ohio (Page 1 of 3)

Common Name	Species Name	Legal Status
Birds		
Black-crowned night-heron	*Nycticorax nycticorax*	ST
Lark sparrow	*Chondestes grammacus*	SE
Least bittern	*Ixobrychus exilis*	ST
Northern harrier	*Circus hudsonius*	SE
Piping plover	*Charadrius melodus*	FE
Red knot	*Calidris canutus rufa*	FE
Upland sandpiper	*Bartramia longicauda*	SE
Insects		
Boreal bluet	*Enallagma boreale*	ST
Green-faced clubtail	*Gomphus viridifrons*	ST
Lilypad forktail	*Ischnura kellicotti*	SE
Marsh bluet	*Enallagma ebrium*	ST
Monarch butterfly	*Danaus plexippus*	FC
none	*Chimarra socia*	SE
none	*Psilotreta indecisa*	ST
none	*Rheopelopia acra*	SE
Northern bluet	*Enallagma cyathigerum*	ST
Racket-tailed emerald	*Dorocordulia libera*	SE
Riffle snaketail	*Ophiogomphus carolus*	ST
Uhler's sundragon	*Helocordulia uhleri*	SE
Fish		
American eel	*Anguilla rostrata*	ST
Cisco	*Coregonus artedi*	SE
Iowa darter	*Etheostoma exile*	SE
Lake sturgeon	*Acipenser fulvescens*	SE
Northern brook lamprey	*Ichthyomyzon fossor*	SE
Pugnose minnow	*Opsopoeodus emiliae*	SE
Shortnose gar	*Lepisosteus platostomus*	SE
Mammal		
Black bear	*Ursus americanus*	SE
Indiana bat	Myotis sodalist	FE
Northern long-eared bat	*Myotis septentrionalis*)	FT
Mussels		
Black sandshell	*Ligumia recta*	ST
Eastern pondmussel	*Ligumia nasuta*	SE

Attachment 1
L-22-113
Table 1 - Threatened or Endangered Species potentially occurring near PNPP or within Lake County, Ohio (Page 2 of 3)

Common Name	Species Name	Legal Status
Mussels		
Fawnsfoot	*Truncilla donaciformis*	ST
Snuffbox	*Epioblasma triquetra*	SE
Threehorn wartyback	*Obliquaria reflexa*	ST
Reptiles		
Eastern Massasauga rattlesnake	*Sistrurus catenatus*	FT
Spotted turtle	*Clemmys guttata*	ST
Plants		
Alpine rush	*Juncus alpinoarticulatus*	ST
American beach grass	*Ammophila breviligulata*	ST
Bristly sarsaparilla	*Aralia hispida*	SE
Bushy cinquefoil	*Potentilla paradoxa*	ST
Canada hawkweed	*Hieracium umbellatum*	ST
Canada St. John's-wort	*Hypericum canadense*	SE
Coastal little bluestem	*Schizachyrium littorale*	SE
Cooper's milk-vetch	*Astragalus neglectus*	ST
Cow-wheat	*Melampyrum lineare*	SE
Dwarf bulrush	*Lipocarpha micrantha*	ST
Early buttercup	*Ranunculus fascicularis*	ST
Few-flowered St. John's-wort	*Hypericum ellipticum*	ST
Flat-stemmed pondweed	*Potamogeton zosteriformis*	ST
Hobblebush	*Viburnum lantanoides*	ST
Inland beach pea	*Lathyrus japonicus*	ST
Keeled bur-reed	*Sparganium androcladum*	ST
Large-leaved mountain-rice	*Oryzopsis asperifolia*	SE
Leafy goldenrod	*Solidago squarrosa*	ST
Leafy tussock sedge	*Carex aquatilis*	ST
Least spike-rush	*Eleocharis parvula*	SE
Log fern	*Dryopteris celsa*	SE
Lyre-leaved rock cress	*Arabidopsis lyrata*	SE
Mountain bindweed	*Fallopia cilinodis*	SE
Necklace sedge	*Carex projecta*	ST
Nodding sedge	*Carex gynandra*	SE
Northern poison-ivy	*Toxicodendron rydbergii*	SE
Rock serviceberry	*Amelanchier sanguinea*	ST
Rock-harlequin	*Corydalis sempervirens*	ST

Attachment 1
L-22-113
Table 1 - Threatened or Endangered Species potentially occurring near PNPP or within Lake County, Ohio (Page 3 of 3)

Common Name	Species Name	Legal Status
Plants		
Short-fringed sedge	*Carex crinita var. brevicrinis*	ST
Sweet-fern	*Comptonia peregrina*	SE
Thread-like naiad	*Najas gracillima*	SE
White wood-sorrel	*Oxalis montana*	SE
Yellow vetchling	*Lathyrus ochroleucus*	ST

FE = federally endangered; FT = federally threatened; SE = state endangered; ST = state threatened; FC = federal candidate species

Table 1 Sources:

1. ODNR. 2016. State Listed Plant Species for Lake County. Retrieved from:

   https://ohiodnr.gov/static/documents/wildlife/state-listed species/lakep.pdf
   (accessed March 1, 2022).

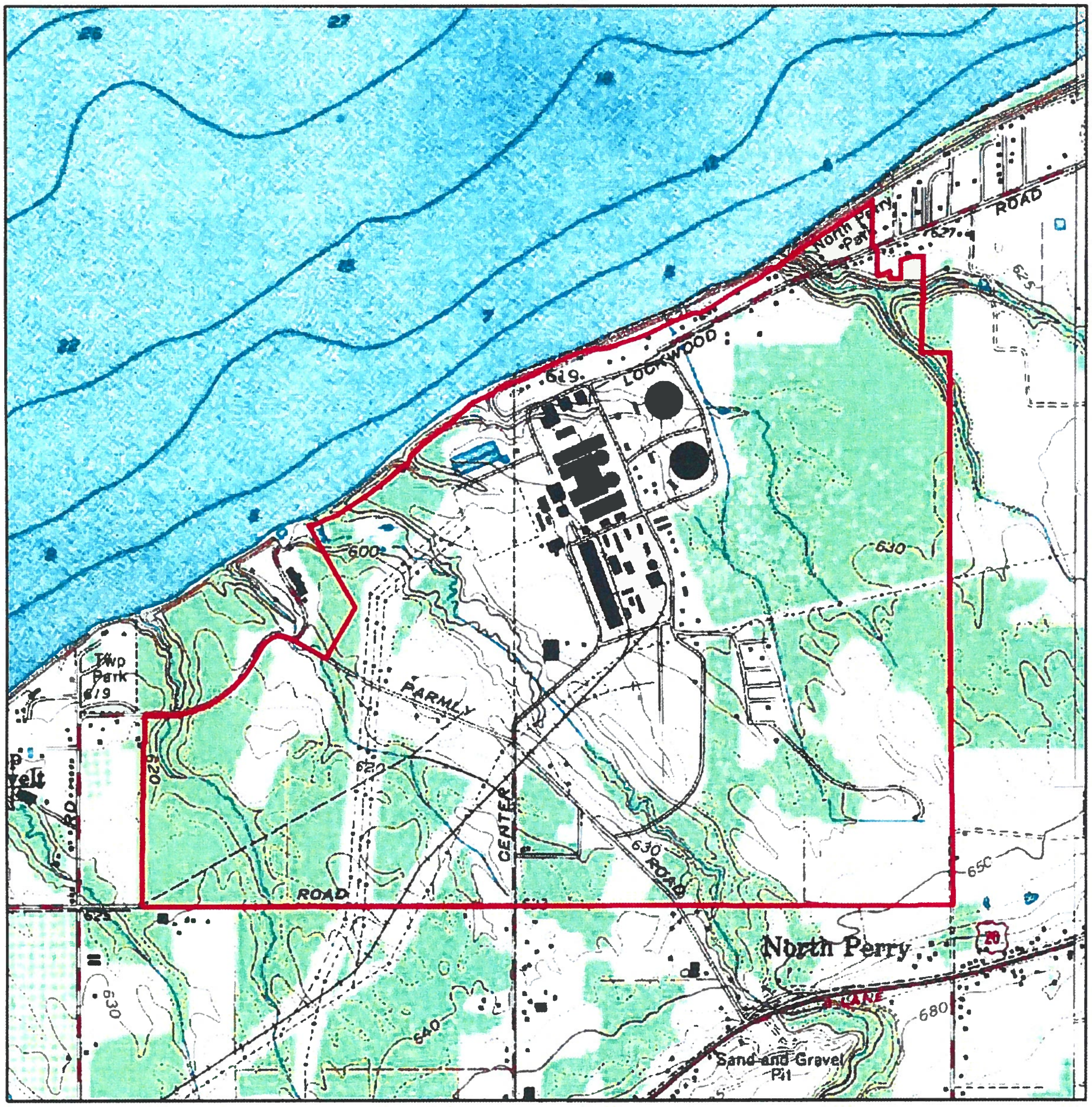
2. ODNR. 2020. State-Listed Animal Species for Lake County. Retrieved from:

   https://ohiodnr.gov/static/documents/wildlife/state-listed-species/lake.pdf
   (accessed March 1, 2022).

3. USFWS 2021. IPaC Resource List. Retrieved from:

   https://ecos.fws.gov/ipac/location/GIYNBWMLQZCHTM76AMX4LXSQCI/resources
   (accessed February 24, 2022)

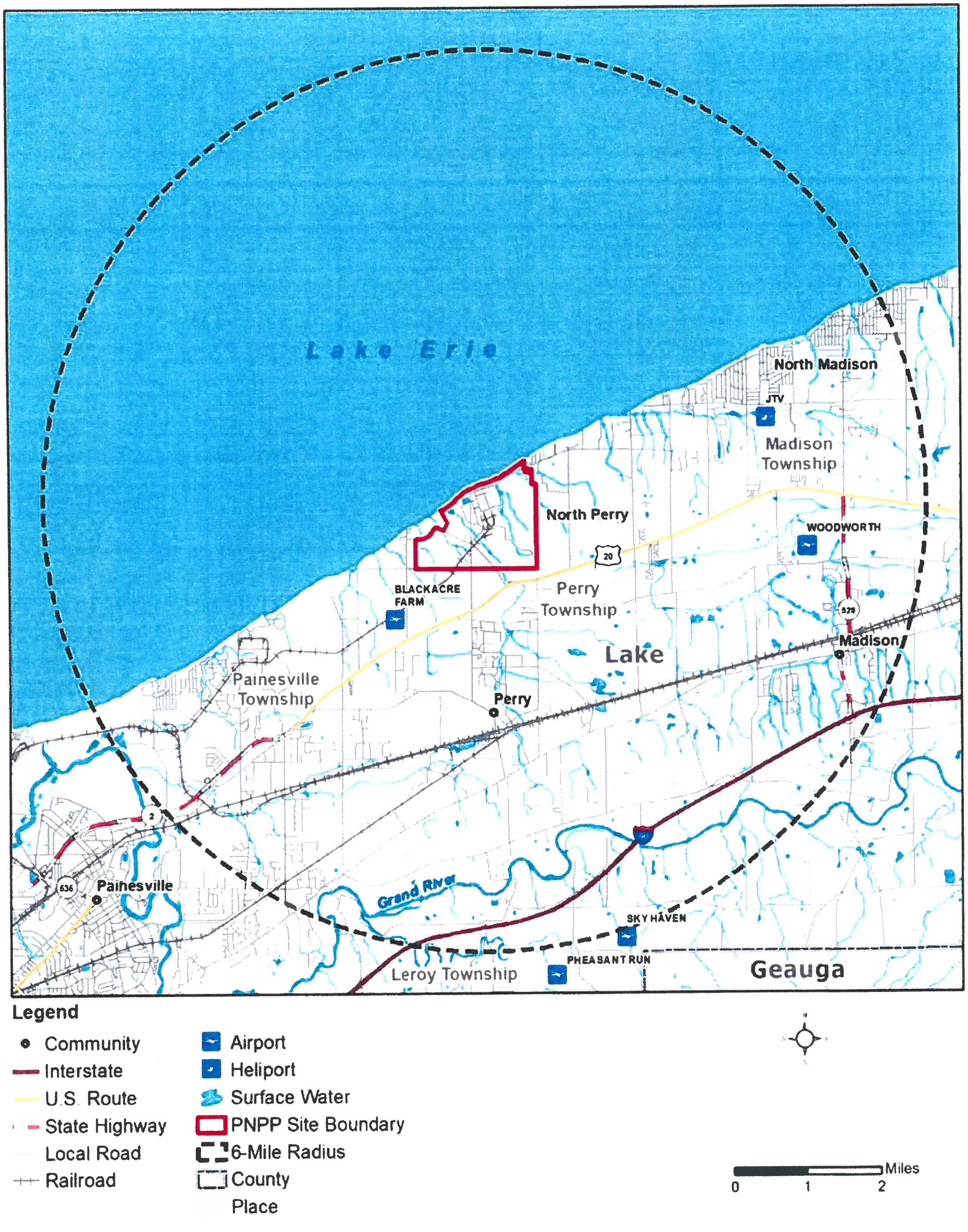
Attachment 2
L-22-113
Figure 1 - PNPP Site



Legend

PNPP Site Boundary

Attachment 3
L-22-113
Figure 2 - PNPP 6-Mile Vicinity



Office of Real Estate
John Kessler, Chief
2045 Morse Road – Bldg. E-2
Columbus, OH 43229
Phone: (614) 265-6621
Fax: (614) 267-4764

September 9, 2022

John Grimm
Energy Harbor, Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Re: 22-0801; Perry Nuclear Power Plant License Renewal

Project: The project is proposing to renew the operating license for Perry Nuclear Power Plant Unit 1 for an additional 20 years.

Location: The proposed project is located in the Village of North Perry, Lake County, Ohio.

The Ohio Department of Natural Resources (ODNR) has completed a review of the above referenced project. These comments were generated by an inter-disciplinary review within the Department. These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the National Environmental Policy Act, the Coastal Zone Management Act, Ohio Revised Code and other applicable laws and regulations. These comments are also based on ODNR's experience as the state natural resource management agency and do not supersede or replace the regulatory authority of any local, state or federal agency nor relieve the applicant of the obligation to comply with any local, state or federal laws or regulations.

Natural Heritage Database: The Natural Heritage Database has the following data at or within one mile of the project area:

American Beach Grass (*Ammophila breviligulata*), T
Golden-fruited Sedge (*Carex aurea*), P
Seaside Spurge (*Euphorbia polygonifolia*), P
Fringed Gentian (*Gentianopsis crinita*), P
Inland Beach Pea (*Lathyrus japonicus*), T
Oakes' Evening-primrose (*Oenothera oakesiana*), P
Bachman's Jelly Lichen (*Enchylium bachmanianum*), T
Spotted Turtle (*Clemmys guttata*), T
Longnose Dace (*Rhinichthys cataractae*), SC
Threehorn Wartyback (*Obliquaria reflexa*), SC
Fawnsfoot (*Truncilla donaciformis*), SC
Deertoe (*Truncilla truncata*), SC
Hemlock-hardwood forest plant community
Mixed mesophytic forest plant community

The review was performed on the specified project area as well as an additional one-mile radius. Records searched date from 1980.

Conservation status abbreviations are as follows: E = state endangered; T = state threatened; P = state potentially threatened; SC = state species of concern; SI = state special interest; U = state status under review; X = presumed extirpated in Ohio; FE = federally endangered, and FT = federally threatened.

Please note that Ohio has not been completely surveyed and we rely on receiving information from many sources. Therefore, a lack of records for an area is not a statement that rare species or unique features are absent from that area. Although all types of plant communities have been surveyed, we only maintain records on the highest quality areas.

Fish and Wildlife: The Division of Wildlife (DOW) has the following comments.

The DOW recommends that impacts to streams, wetlands and other water resources be avoided and minimized to the fullest extent possible, and that Best Management Practices be utilized to minimize erosion and sedimentation.

The entire state of Ohio is within the range of the Indiana bat (*Myotis sodalis*), a state endangered and federally endangered species, the northern long-eared bat (*Myotis septentrionalis*), a state endangered and federally threatened species, the little brown bat (*Myotis lucifugus*), a state endangered species, and the tricolored bat (*Perimyotis subflavus*), a state endangered species. During the spring and summer (April 1 through September 30), these species of bats predominately roost in trees behind loose, exfoliating bark, in crevices and cavities, or in the leaves. However, these species are also dependent on the forest structure surrounding roost trees. If trees are present within the project area, and trees must be cut, the DOW recommends cutting only occur from October 1 through March 31, conserving trees with loose, shaggy bark and/or crevices, holes, or cavities, as well as trees with DBH ≥ 20 if possible. If trees are present within the project area, and trees must be cut during the summer months, the DOW recommends a mist net survey or acoustic survey be conducted from June 1 through August 15, prior to any cutting. Mist net and acoustic surveys should be conducted in accordance with the most recent version of the "*OHIO DIVISION OF WILDLIFE GUIDANCE FOR BAT SURVEYS AND TREE CLEARING*". If state listed bats are documented, DOW recommends cutting only occur from October 1 through March 31. However, limited summer tree cutting may be acceptable after consultation with the DOW (contact Eileen Wyza at Eileen.Wyza@dnr.ohio.gov).

The DOW also recommends that a desktop habitat assessment is conducted, followed by a field assessment if needed, to determine if a potential hibernaculum is present within the project area. Direction on how to conduct habitat assessments can be found in the current USFWS "*RANGE-WIDE INDIANA BAT & NORTHERN LONG-EARED BAT SURVEY GUIDELINES*." If a habitat assessment finds that a potential hibernaculum is present within 0.25 miles of the project area, please send this information to Eileen Wyza for project recommendations. If a potential or known hibernaculum is found, the DOW recommends a 0.25-mile tree cutting and subsurface disturbance buffer around the hibernaculum entrance, however, limited summer or winter tree cutting may be acceptable after consultation with the DOW. If no tree cutting or subsurface impacts to a hibernaculum are proposed, this project is not likely to impact these species.

The project is within range of the following listed fish species.
State Endangered
lake sturgeon (*Acipenser fulvescens*)
cisco (*Coregonus artedi*)
Iowa darter (*Etheostoma exile*)
northern brook lamprey (*Ichthyomyzon fossor*)
pugnose minnow (*Opsopoeodus emiliae*)
shortnose gar (*Lepisosteus platostomus*)

State Threatened
American eel (*Anguilla rostrata*)

The DOW recommends no in-water work from March 15 through June 30 to reduce impacts to indigenous aquatic species and their habitat. If no in-water work is proposed, this project is not likely to impact these or other aquatic species.

Records exist from the project area for the spotted turtle (*Clemmys guttata*), a state threatened species. This species prefers fens, bogs and marshes, but also is known to inhabit wet prairies, meadows, pond edges, wet woods, and the shallow sluggish waters of small streams and ditches. Because this is only a relicensing without any land or habitat disturbance planned, impacts to this species are not likely.

The project is within the range of the northern harrier (*Circus hudsonis*), a state endangered bird. This is a common migrant and winter species. Nesters are much rarer, although they occasionally breed in large marshes and grasslands. Harriers often nest in loose colonies. The female builds a nest out of sticks on the ground, often on top of a mound. Harriers hunt over grasslands. Nesting of this species occurs from April 15 through July 31. Because this is only a relicensing without any land or habitat disturbance planned, impacts to this species are not likely.

Due to the potential of impacts to federally listed species, as well as to state listed species, we recommend that this project be coordinated with the US Fish & Wildlife Service.

Water Resources: The Division of Water Resources has the following comment.

The local floodplain administrator should be contacted concerning the possible need for any floodplain permits or approvals for this project.

ODNR appreciates the opportunity to provide these comments. Please contact Mike Pettegrew at mike.pettegrew@dnr.ohio.gov if you have questions about these comments or need additional information.

Mike Pettegrew
Environmental Services Administrator

energy harbor

Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

May 12, 2022
L-22-115

10 CFR 50.51

ATTN: Patricia Ashfield
Field Office Supervisor, Project Leader
Ohio Ecological Services Field Office
U.S. Fish and Wildlife Service
4625 Morse Road, Suite 104
Columbus, OH 4320-8355

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan

Dear Ms. Ashfield,

Energy Harbor is preparing an application for renewing the operating license for the Perry Nuclear Power Plant Unit 1 (PNPP) for an additional 20 years (see table below). Energy Harbor is contacting you for assistance in assessing the impacts from continued operation during the license period.

PNPP Licensing Dates

PNPP Unit	Initial License Expiration Date	License Renewal Expiration Date
Unit 1	November 7, 2026	November 7, 2046

As part of the process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment to be undertaken to enable the continued operation of the unit.

The ER addresses the potential to impact species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA), and important plant and animal habitats, including critical habitats as defined by the ESA and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

This letter seeks input from the U.S. Fish and Wildlife Service (USFWS) regarding such effects in the vicinity of the PNPP. Also, as part of the renewal process, the NRC may request consultation with your agency regarding the license renewal. To facilitate our assessment and a smooth consultation by the NRC, we are contacting you early in the application process seeking input regarding the effects that license renewal activities may have on listed species (or candidates proposed for listing) and important plant habitats within the plant's environs and any questions or additional information necessary for the consultation process. Figures that depict the plant site boundary and the vicinity within a 6-mile radius of the plant and a table of listed species in the plant's vicinity are attached. A brief discussion of the plant and its operations during the renewal period is provided below.

The PNPP is located in the village of North Perry in Lake County, Ohio. The site is situated on approximately 1,030 acres on the southern shores of Lake Erie. In accordance with the NRC regulations, the transmission lines within the scope of the license renewal are those located within the PNPP site boundary.

Species potentially occurring near the PNPP site, or within Lake County (the only county within a 6-mile radius of the site) that are currently federally, or state listed as threatened or endangered are included in the attached Table 1.

During the license renewal term, Energy Harbor proposes to continue operating the unit as currently operated. There are currently no ground-disturbing activities other than those to maintain existing structures and operations anticipated at the PNPP site during the license renewal period. Additionally, Energy Harbor does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

Energy Harbor does not anticipate the continued operation of PNPP to adversely affect the environment or any cultural or historic resources.

As stated earlier, this letter seeks your input on the proposed continued operation of the PNPP regarding listed species and important habitats within the environs of the plant. We appreciate your notifying us of your comments and any information you believe Energy Harbor should consider in the preparation of the ER. Your input is requested by 6/13/2022. Energy Harbor plans to include this letter and any response you provide in the final ER.

Should you or your staff have any questions or comments, please contact Ben Spiesman at (440) 477-1835 or via email at bspiesman@energyharbor.com.

Sincerely,

Rod L. Penfield

Attachments:

1. Table 1 - Threatened or Endangered Species potentially occurring near the PNPP or within Lake County, Ohio
2. Figure 1 - PNPP Site
3. Figure 2 - PNPP 6-mile Vicinity

cc: T. Lentz
R. Turney-Work, Enercon Services
S. Burgess, Enercon Services

Attachment 1
L-22-115

Table 1 - Threatened and Endangered Species Potentially Occurring Near the Perry Nuclear Power Plant (PNPP) or within Lake County, Ohio (Page 1 of 3)

Common Name	Species Name	Legal Status
Birds		
Black-crowned night-heron	*Nycticorax nycticorax*	ST
Lark sparrow	*Chondestes grammacus*	SE
Least bittern	*Ixobrychus exilis*	ST
Northern harrier	*Circus hudsonius*	SE
Piping plover	*Charadrius melodus*	FE
Red knot	*Calidris canutus rufa*	FE
Upland sandpiper	*Bartramia longicauda*	SE
Insects		
Boreal bluet	*Enallagma boreale*	ST
Green-faced clubtail	*Gomphus viridifrons*	ST
Lilypad forktail	*Ischnura kellicotti*	SE
Marsh bluet	*Enallagma ebrium*	ST
Monarch butterfly	*Danaus plexippus*	FC
none	*Chimarra socia*	SE
none	*Psilotreta indecisa*	ST
none	*Rheopelopia acra*	SE
Northern bluet	*Enallagma cyathigerum*	ST
Racket-tailed emerald	*Dorocordulia libera*	SE
Riffle snaketail	*Ophiogomphus carolus*	ST
Uhler's sundragon	*Helocordulia uhleri*	SE
Fish		
American eel	*Anguilla rostrata*	ST
Cisco	*Coregonus artedi*	SE
Iowa darter	*Etheostoma exile*	SE
Lake sturgeon	*Acipenser fulvescens*	SE
Northern brook lamprey	*Ichthyomyzon fossor*	SE
Pugnose minnow	*Opsopoeodus emiliae*	SE
Shortnose gar	*Lepisosteus platostomus*	SE
Mammal		
Black bear	*Ursus americanus*	SE
Indiana bat	Myotis sodalist	FE
Northern long-eared bat	*Myotis septentrionalis*)	FT
Mussels		
Black sandshell	*Ligumia recta*	ST
Eastern pondmussel	*Ligumia nasuta*	SE

Attachment 1
L-22-115
Table 1 - Threatened and Endangered Species Potentially Occurring Near the PNPP or within Lake County, Ohio (Page 2 of 3)

Common Name	Species Name	Legal Status
Mussels		
Fawnsfoot	*Truncilla donaciformis*	
Snuffbox	*Epioblasma triquetra*	SE
Threehorn wartyback	*Obliquaria reflexa*	ST
Reptiles		
Eastern Massasauga rattlesnake	*Sistrurus catenatus*	FT
Spotted turtle	*Clemmys guttata*	ST
Plants		
Alpine rush	*Juncus alpinoarticulatus*	ST
American beach grass	*Ammophila breviligulata*	ST
Bristly sarsaparilla	*Aralia hispida*	SE
Bushy cinquefoil	*Potentilla paradoxa*	ST
Canada hawkweed	*Hieracium umbellatum*	ST
Canada St. John's-wort	*Hypericum canadense*	SE
Coastal little bluestem	*Schizachyrium littorale*	SE
Cooper's milk-vetch	*Astragalus neglectus*	ST
Cow-wheat	*Melampyrum lineare*	SE
Dwarf bulrush	*Lipocarpha micrantha*	ST
Early buttercup	*Ranunculus fascicularis*	ST
Few-flowered St. John's-wort	*Hypericum ellipticum*	ST
Flat-stemmed pondweed	*Potamogeton zosteriformis*	ST
Hobblebush	*Viburnum lantanoides*	ST
Inland beach pea	*Lathyrus japonicus*	ST
Keeled bur-reed	*Sparganium androcladum*	ST
Large-leaved mountain-rice	*Oryzopsis asperifolia*	SE
Leafy goldenrod	*Solidago squarrosa*	ST
Leafy tussock sedge	*Carex aquatilis*	ST
Least spike-rush	*Eleocharis parvula*	SE
Log fern	*Dryopteris celsa*	SE
Lyre-leaved rock cress	*Arabidopsis lyrata*	SE
Mountain bindweed	*Fallopia cilinodis*	SE
Necklace sedge	*Carex projecta*	ST
Nodding sedge	*Carex gynandra*	SE
Northern poison-ivy	*Toxicodendron rydbergii*	SE
Rock serviceberry	*Amelanchier sanguinea*	ST
Rock-harlequin	*Corydalis sempervirens*	ST

Attachment 1

L-22-115

Table 1 - Threatened and Endangered Species Potentially Occurring Near the PNPP or within Lake County, Ohio (Page 3 of 3)

Common Name	Species Name	Legal Status
Plants		
Short-fringed sedge	*Carex crinita var. brevicrinis*	ST
Sweet-fern	*Comptonia peregrina*	SE
Thread-like naiad	*Najas gracillima*	SE
White wood-sorrel	*Oxalis montana*	SE
Yellow vetchling	*Lathyrus ochroleucus*	ST

FE = federally endangered; FT = federally threatened; SE = state endangered; ST = state threatened; FC = federal candidate species

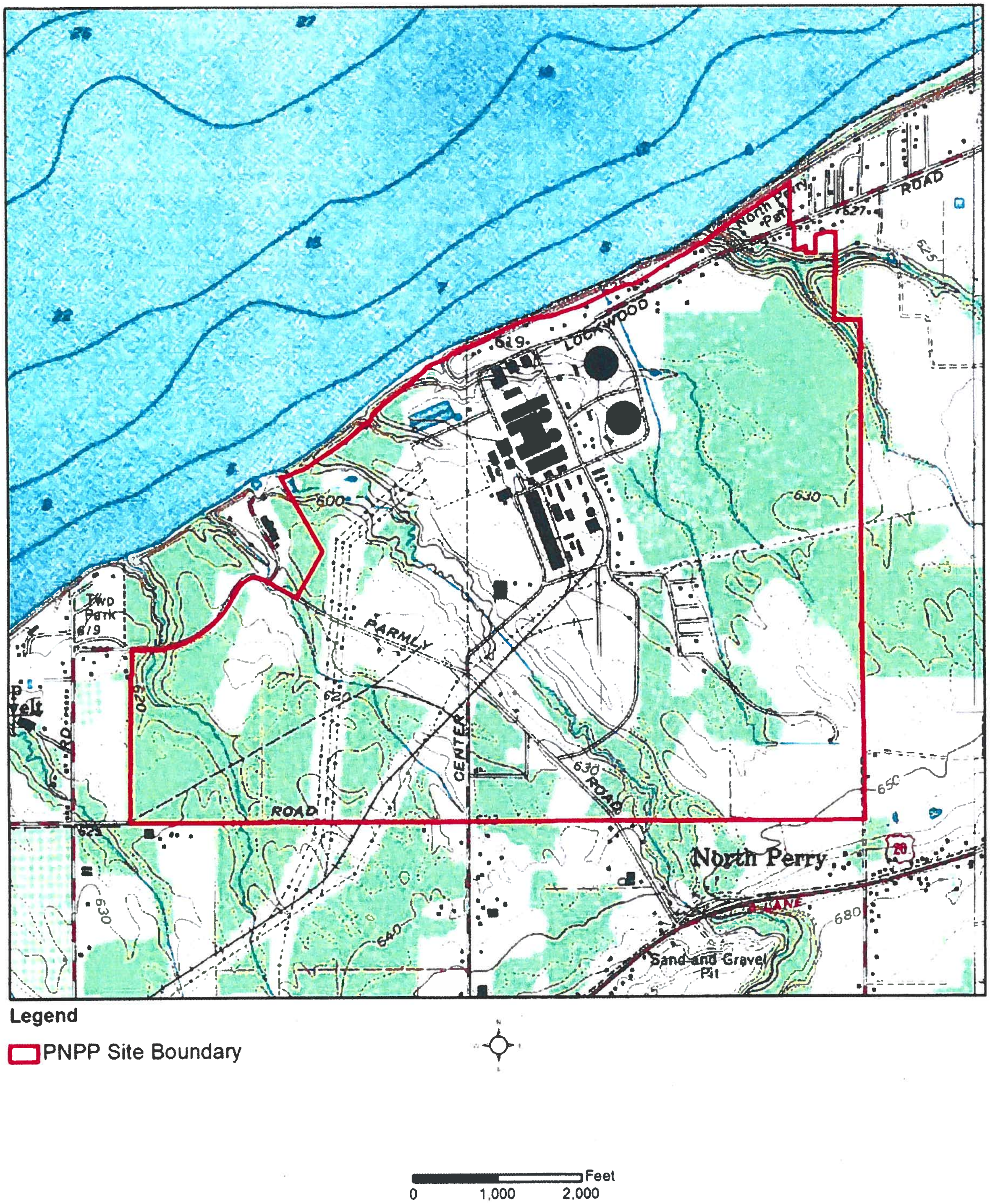
Table 1 Sources:

ODNR. 2016. State Listed Plant Species for Lake County. Retrieved from https://ohiodnr.gov/static/documents/wildlife/state-listed species/lakep.pdf (accessed February 24, 2022).

ODNR. 2020. State-Listed Animal Species for Lake County. Retrieved from https://ohiodnr.gov/static/documents/wildlife/state-listed species/lakep.pdf (accessed March 1, 2022).

USFWS 2021. IPaC Resource List. Retrieved from https://ecos.fws.gov/ipac/location/GIYNBWMLQZCHTM76AMX4LXSQCI/resources (accessed February 24, 2022).

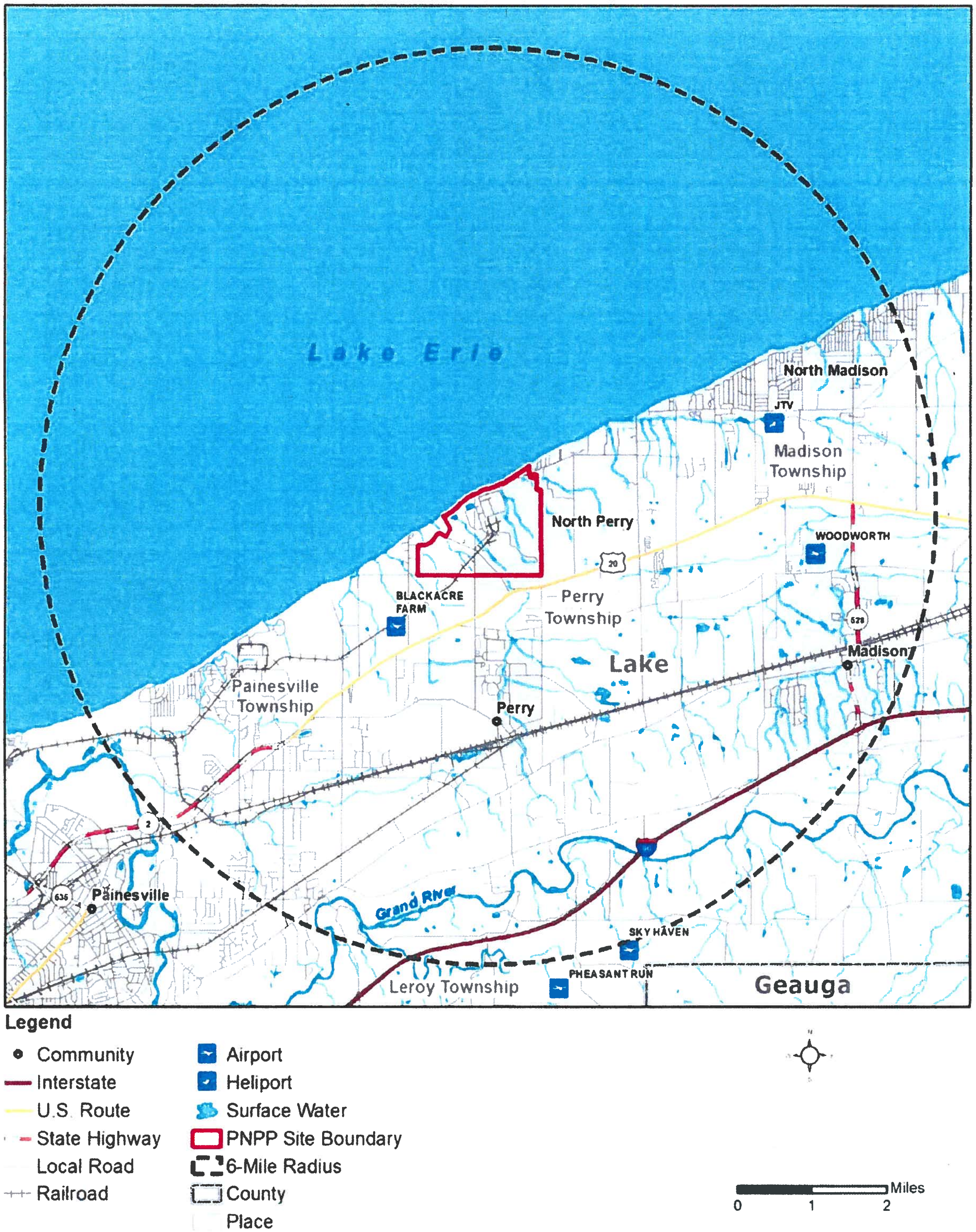
Attachment 2
L-22-115
Figure 1 - PNPP Site



Attachment 3

L-22-115

Figure 2 - PNPP 6-Mile Vicinity



energy harbor

Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

May 12, 2022
L-22-116

10 CFR 50.51

ATTN: Kimberly Damon-Randall
Director, National Oceanic and Atmospheric Administration (NOAA) Fisheries
Office of Protected Resources
1315 East-West Highway
Silver Spring, MD 20910

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan

Dear Ms. Damon-Randall,

Energy Harbor is preparing an application for renewing the operating license for the Perry Nuclear Power Plant Unit 1 (PNPP) for an additional 20 years (see the table below). As part of the license renewal process, the U.S. Nuclear Regulatory Commission (NRC) may request an informal or formal consultation with your agency. It is our intent by this letter to introduce you to the project, and to make available any data you need to ensure an efficient and effective consultation process.

PNPP Licensing Dates

PNPP Unit	Initial License Expiration Date	License Renewal Expiration Date
Unit 1	November 7, 2026	November 7, 2046

As part of the renewal process, the NRC requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment undertaken to enable the continued operation of the unit.

The ER will address the potential impact on species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA), and important plant and animal habitats, including critical habitats as defined by the ESA and essential fish habitat (EFH) as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

As part of the renewal process, the NRC may request a consultation with your agency regarding the license renewal. The time frame for the NRC consultation request is anticipated to be within a few months of Energy Harbor's application submittal, currently scheduled for mid-2023. Therefore, to facilitate our assessment and a smooth consultation by the NRC, we are contacting you early in the application process seeking input regarding the effects that license renewal activities may have on listed species under your jurisdiction and important aquatic habitats within the station's environs, and any questions or additional information necessary for the consultation process.

Specifically, this letter seeks input from the National Oceanic and Atmospheric Administration (NOAA) Fisheries Office regarding such effects in the vicinity of PNPP. There are no marine or anadromous species known to occur near the PNPP site that are currently under NOAA Fisheries' jurisdiction. However, your concurrence that no species or designated critical habitat (DCH) under your jurisdiction or EFH would be affected by continued operations at PNPP is requested.

Figures that depict the plant site boundary and the vicinity within a 6-mile radius of the plant are attached and a brief discussion of the plant and its operations during the renewal period is provided below.

The PNPP is located in the village of North Perry in Lake County, Ohio. The site is situated on approximately 1,030 acres on the southern shores of Lake Erie. In accordance with the NRC regulations, the transmission lines within the scope of the license renewal are those located within the PNPP site boundary

During the license renewal term, Energy Harbor proposes to continue operating the unit as currently operated. There are currently no ground-disturbing activities other than those to maintain existing structures and operations anticipated at the PNPP site during the license renewal period. Additionally, Energy Harbor does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process. Energy Harbor does not anticipate the continued operation of PNPP to adversely affect the environment, sensitive species, or habitats.

As previously stated, this letter seeks your concurrence that continued operation of the PNPP would not affect listed species or DCH under your jurisdiction or any EFH. We appreciate your notifying us of your comments and any information or actions required of Energy Harbor to assist in the preparation of our ER. Your input is requested by 6/13/2022. Energy Harbor plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ben Spiesman at (440) 477-1835 or via email at bspiesman@energyharbor.com.

Sincerely,

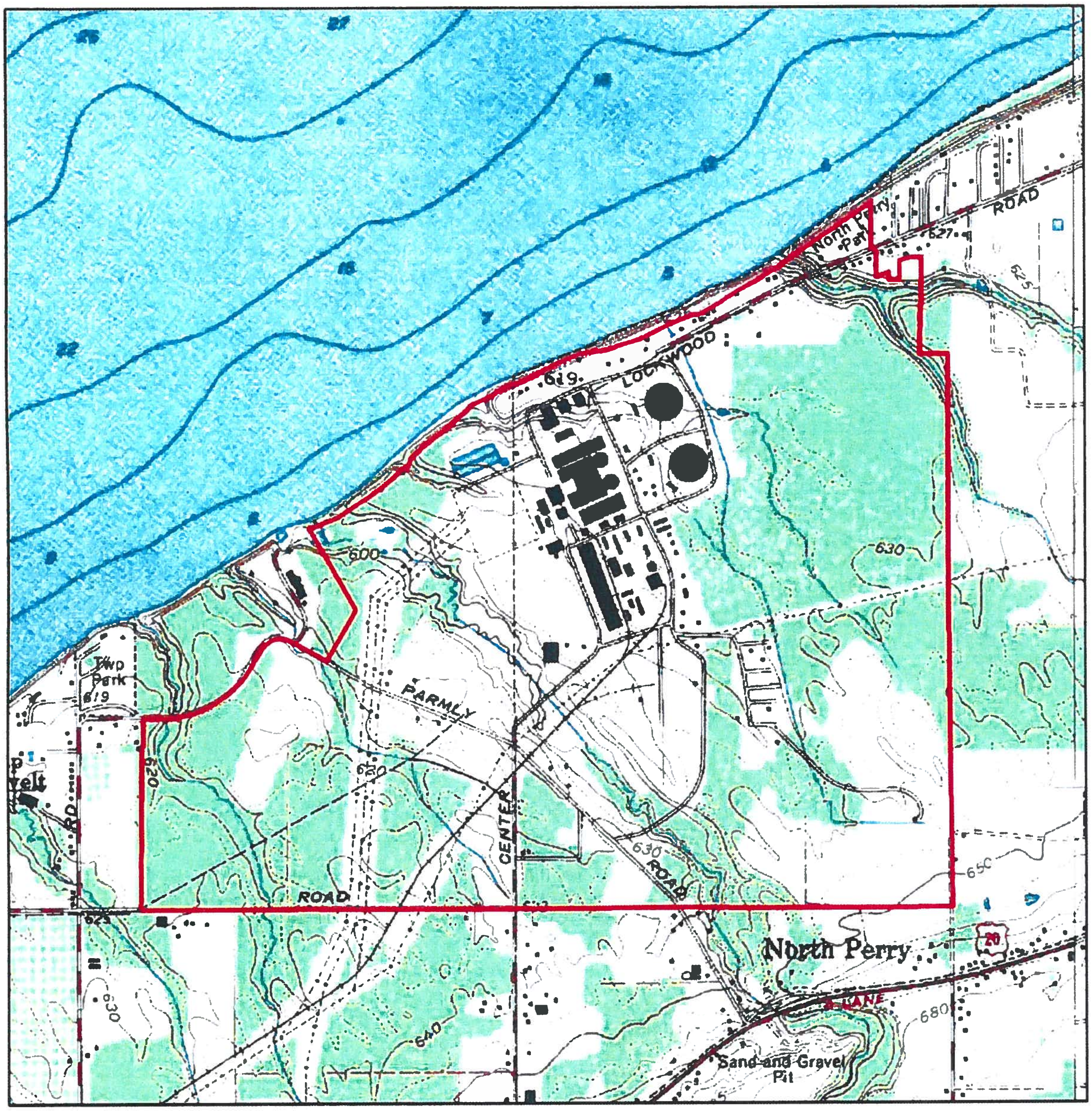
Rod L. Penfield

Attachments:

1. Figure 1 - PNPP Site
2. Figure 2 - PNPP 6-mile Vicinity

cc: T. Lentz
R. Turney-Work, Enercon Services
S. Burgess, Enercon Services

Attachment 1
L-22-116
Figure 1 - PNPP Site

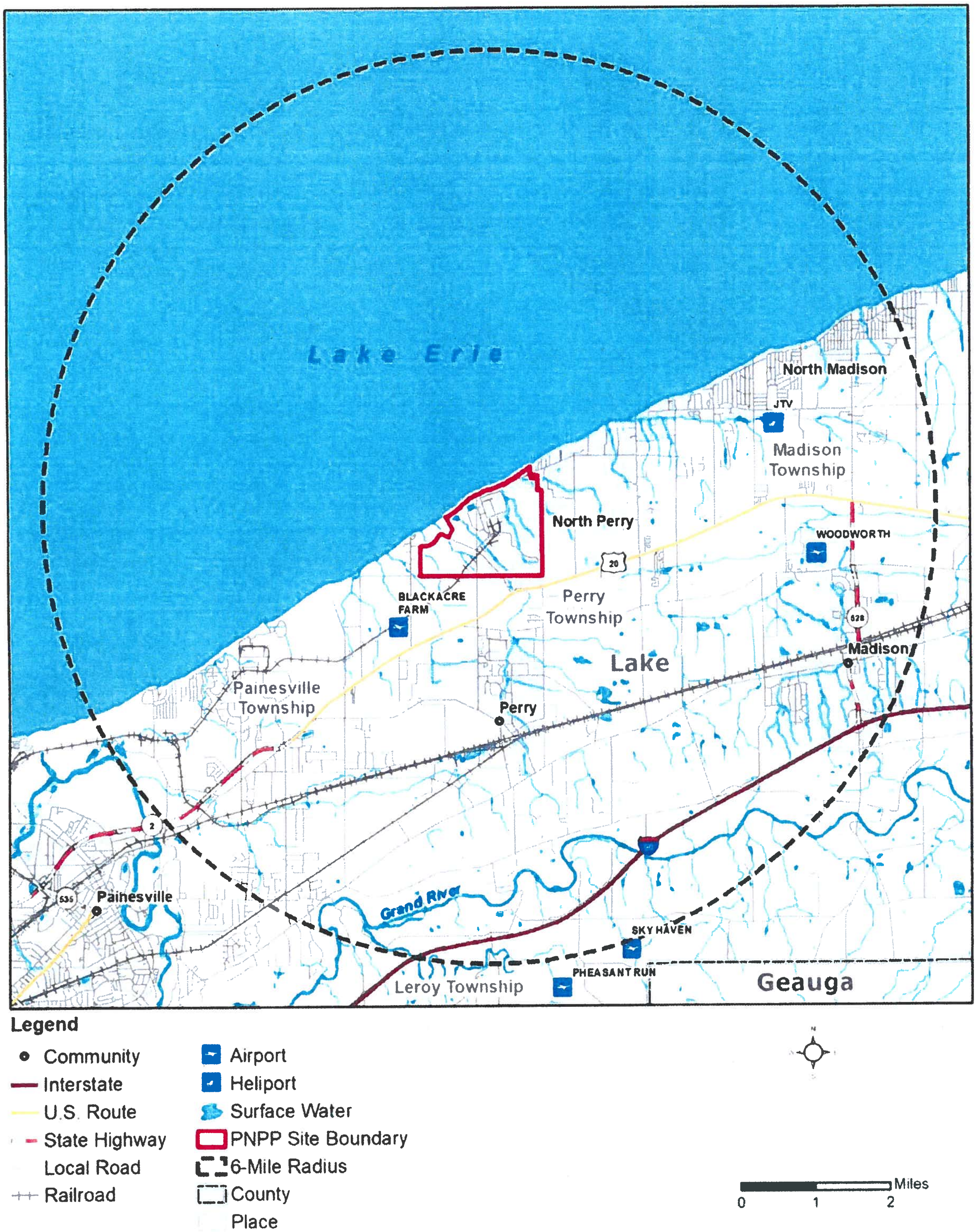


Legend

PNPP Site Boundary

0 1,000 2,000 Feet

Attachment 2
L-22-116
Figure 2 - PNPP 6-Mile Vicinity



From: Kimberly Damon-Randall - NOAA Federal <kimberly.damon-randall@noaa.gov>
Sent: Tuesday, October 11, 2022 11:48 AM
To: Grimm, John
Cc: Travis Thyberg - NOAA Federal <travis.thyberg@noaa.gov>
Subject: [External] Energy Harbor NOAA protected species inquiry

Dear Mr. Grimm,

NOAA/NMFS appreciates being included in the permit review for the Perry Nuclear Power Plant in Cleveland, OH. Our initial review indicates that the Office of Protected Resources under NOAA, does not have any species under management in this area. As such, no further follow up with our office is necessary.

While our office is not aware of any NOAA essential fish habitat in Ohio, we have forwarded your request for information to the Office of Habitat to see if this is accurate. In case it is helpful, here is a link to the official habitat mapper https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper. Please feel free to pass this link along to the contracting agency that is working on your environmental review.

We understand that this inquiry has also been sent to the U.S. Fish and Wildlife Service, and we would encourage follow up with them to determine whether there are ESA protected species under their jurisdiction in your project area.

Kind regards,
Kim

Attachment D: Cultural Resources Consultation

energy harbor

Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

May 12, 2022
L-22-112

10 CFR 50.51

ATTN: Burt Logan
Ohio History Connection
800 East 17th Avenue
Columbus, OH 43211

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan

Dear Mr. Logan,

Energy Harbor is preparing an application for renewing the operating license for Perry Nuclear Power Plant Unit 1 (PNPP) for an additional 20 years (see the table below). As part of the process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment to be undertaken to enable the continued operation of the unit. The ER addresses the potential to impact historic and cultural resources including tribal cultural resources on or near the PNPP site.

Table 1. PNPP Licensing Dates

PNPP Unit	Initial License Expiration Date	License Renewal Expiration Date
Unit 1	November 7, 2026	November 7, 2046

This letter seeks input from the Ohio History Connection regarding the effects near the plant from the renewal of PNPP's license.

As part of the renewal process, the NRC may request consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), and the federal Advisory Council on Historic Preservation regulations (36 CFR 800) with your agency regarding the license renewal. The timeframe for the NRC consultation request is anticipated to be within a few months of Energy Harbor's application submittal, currently scheduled for mid-2023.

To facilitate our preparation of the license renewal ER and a smooth consultation by the NRC, we are contacting you early in the application process seeking input regarding the effects that license renewal activities may have on historic and cultural resources within the plant's environs and any questions or additional information necessary for the consultation process. Tables of known archaeological sites, historic structures, cemeteries, and National Register of Historic Places (NRHP) properties in the plant's vicinity (Tables 1 through 4) and figures that depict the plant site boundary and the vicinity within a 6-mile radius of the plant (Figures 1 and 2) are attached. A brief discussion of the plant and its operations during the renewal period of operation is provided below.

The PNPP is in the village of North Perry in Lake County, Ohio. The site is situated on approximately 1,030 acres on the southern shores of Lake Erie. In accordance with the NRC regulations, the transmission lines within the scope of the license renewal are those located within the PNPP site boundary.

During the license renewal term, Energy Harbor proposes to continue operating the unit as currently operated. There are currently no ground-disturbing activities other than those to maintain existing structures and operations anticipated at the PNPP site during the license renewal period. Currently, Energy Harbor does not anticipate any refurbishment because of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

Energy Harbor does not anticipate the continued operation of PNPP to adversely affect the environment or any cultural or historic resources.

As stated earlier, this letter seeks your input on the proposed continued operation of PNPP on historic and cultural resources, including tribal cultural resources, within the environs of the plant. Please notify us of concerns and any information you believe Energy Harbor should consider in the preparation of the ER. Your input is requested by 6/13/2022. Energy Harbor plans to include this letter and any response you provide in the final ER.

We request that you send your letter response to Ben Spiesman. Should you or your staff have any questions or comments, please contact Ben at (440) 477-1835 or via email at bspiesman@energyharbor.com.

Sincerely,

Rod L. Penfield

Attachments:

1. Table 1 - Archaeological Sites and DOE listings within 6-miles of PNPP
2. Table 2 - Historic Structures Entries within 6-miles of PNPP
3. Table 3 - Cemeteries within 6-miles of PNPP
4. Table 4 - National Register of Historic Places (NRHP) Properties within 6-miles of PNPP
5. Table Sources
6. Figure 1 - PNPP Site
7. Figure 2 - PNPP 6-mile Vicinity

cc: T. Lentz
R. Turney-Work, Enercon Services
S. Burgess, Enercon Services

Attachment 1
L-22-112
Table 1 - Archaeological Sites and DOE listings within 6-miles of Perry Nuclear Power Plant (PNPP) (Page 1 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0002 NRHP#74001543	Painesville	Prehistoric to Historic period fort	Listed on the NRHP 74001543
LA0003	Painesville	Painesville Village site with unknown Woodland components excavated in 1934	Unassessed
LA0019	Painesville	Unassigned prehistoric lithic scatter (N=16)	Unassessed
LA0020	Perry	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0021	Painesville	Unassigned Prehistoric site based on the reported location of projectile points finds	Unassessed
LA0022	Painesville	Unassigned prehistoric lithic scatter (N=5)	Unassessed Reported destroyed
LA0023	Painesville	Unassigned Archaic site	Unassessed
LA0024	Painesville	Unassigned prehistoric lithic scatter (N=5)	Unassessed Reported destroyed
LA0032	Thompson	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0033	Madison	Unassigned prehistoric lithic scatter (N=8)	Unassessed
LA0034	Thompson	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0035	Thompson	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0043	Madison	Early Woodland Adena point	Unassessed
LA0044	Madison	Isolated find of an unassigned Archaic projectile point	Unassessed
LA0046	Madison	Multicomponent artifact collection with diagnostics from the unknown, Late Archaic, and Early and Late Woodland Periods	Unassessed
LA0055	Madison	Late Archaic artifact collection	Unassessed

(OMS-OHC 2022a)
a. DOE listed.

Attachment 1
L-22-112
Table 1 - Archaeological Sites and DOE listings within 6-miles of PNPP (Page 2 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0059	Perry	Unassigned prehistoric site with an unknown Archaic lithic point	Unassessed
LA0060	Perry	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0061	Perry	Unassigned prehistoric lithic scatter (N=9)	Unassessed
LA0062	Perry	Unassigned prehistoric lithic scatter (N=30)	Unassessed
LA0064	Perry	Multicomponent artifact collection with diagnostics from the Paleoindian, Early to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0065	Madison	Multicomponent artifact collection with diagnostics from the Paleoindian, Early to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0066	Madison	Multicomponent artifact collection with diagnostics from the Late Woodland Period	Unassessed
LA0077	Madison	Multicomponent artifact collection with diagnostics from the Paleoindian, Middle to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0078	Madison	Multicomponent artifact collection with diagnostic from the, Unknown, Early & Late Archaic, and unknown, Early & Late Woodland Periods	Unassessed
LA0080	Madison	W. T. Baster Family 19^{th} century graveyard	Protected by State burial laws

(OMS-OHC 2022a)
a. DOE listed.

Attachment 1
L-22-112
Table 1 - Archaeological Sites and DOE listings within 6-miles of PNPP (Page 3 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0095	Painesville	Lithic scatter with an Early Woodland point (N=51)	Unassessed
LA0096	Painesville	Unassigned prehistoric lithic scatter (N=19)	Unassessed
LA0097	Madison	Multicomponent site with unassigned prehistoric lithic scatter (N=7) and two fragments of smelting glass	Unassessed
LA0098	Madison	Unassigned prehistoric lithic scatter (N=11)	Unassessed
LA0099	Perry	Unassigned prehistoric lithic scatter (N=5)	Unassessed
LA0100	Perry	Unassigned prehistoric lithic scatter (N=5)	Unassessed
LA0113	Painesville	An unassigned prehistoric cemetery where 23 graves were reportedly removed	Reported destroyed, Unassessed
LA0122	Perry	Late Woodland lithic scatter (N=32)	Unassessed
LA0123	Perry	Unassigned prehistoric lithic scatter with an unknown Archaic point (N=14)	Unassessed
LA0129	Madison	Unassigned prehistoric lithic scatter (N=18)	Unassessed
LA0130	Madison	Unassigned prehistoric lithic scatter (N=18)	Unassessed
LA0137	Perry	Middle Archaic lithic scatter with a St. Albans bifurcate point, debitage, two incomplete bifaces, one flake scraper, and 3 deer bone fragments (tested)	Unassessed Noted as destroyed
LA0138	Perry	Unassigned prehistoric lithic scatter (items not listed), tested	Unassessed No further work recommended

(OMS-OHC 2022a)
a. DOE listed.

Attachment 1

L-22-112

Table 1 - Archaeological Sites and DOE listings within 6-miles of PNPP (Page 4 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0158[a]	Painesville	Multicomponent 1810-1840 cabin site/Late Woodland Village site with features	Recommended potentially eligible, criteria D 1991, DOE 3926
LA0160	Perry	Late Woodland site with fire pits, a house feature, pottery, animal bone, lithic tools, debitage, and floral remains N=4,221	Unassessed
LA0165	Painesville	The reported location of a Late Woodland to Late Prehistoric cemetery	Unassessed
LA0170	Painesville	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0171	Perry	19th to early 20th century farmstead with two foundations, a barn and scatter of domestic refuse (N=9)	Unassessed
LA0172	Perry	19th to 20th century domestic debris scatter (N=7)	Unassessed
LA0173	Perry	19th to 20th century domestic debris scatter (N=19)	Unassessed
LA0174	Perry	19th to 20th century domestic debris scatter (N=8)	Unassessed (Removed from State Registry)
LA0175	Perry	Unassigned prehistoric lithic scatter (N=5) and the Possible 1854 Parmly Family Cemetery	Prehistoric unassessed 19th century cemetery is protected by State burial laws
LA0176	Perry	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0177	Perry	Unassigned prehistoric lithic scatter (N=1)	Unassessed

(OMS-OHC 2022a)

a. DOE listed.

Attachment 1

L-22-112

Table 1 - Archaeological Sites and DOE listings within 6-miles of PNPP (Page 5 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0181	Madison	19th to 20th century domestic debris scatter from a farmstead	Unassessed
LA0182	Madison	A mid-20th century concrete capped water well,	Unassessed
LA0183	Madison	Unassigned lithic scatter with an unknown Woodland ceramic sherd (N=80)	Unassessed
LA0184	Madison	Unassigned non-aboriginal surface domestic trash scatter	Unassessed
LA0185	Madison	Non-aboriginal surface domestic refuse scatter circa 1880 to 1929	Unassessed
LA0196	Painesville	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0197	Painesville	Isolated find of a single flake	Unassessed
LA0219	Offshore	ESCO#Allegheny/King Coal shipwreck 1970	"No National Register potential"
LA0220	Offshore	Red Bird shipwreck from prior to 1903	"No National Register potential"
LA0221	Offshore	Charles B. Hill/Delaware shipwreck	"No National Register potential"
LA0225	Perry	Mid-20th century refuse and architectural debris scatter (N=8)	Unassessed
LA0226	Perry	1930 to 1960 surface scatter of domestic refuse (N=8)	Unassessed
LA0227	Perry	Two solarized glass vessel fragments with a manufacture date from 1870 to 1914	Unassessed No further work recommended
LA0228	Perry	Isolated find of a Late Archaic projectile point base	Unassessed
DOE 2352[a]		Cobblestone House	Determined eligible

(OMS-OHC 2022a)

a. DOE listed.

Attachment 2

L-22-112

Table 2 - Historic Structures Entries within 6-miles of PNPP (Page 1 of 5)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0000407[b]	Dr. J. C. Winan House	Single Dwelling	Eastlake	5.3 miles
LAK0000506	J. Mcvitty House	Single Dwelling	Queen Anne	2.9 miles
LAK0000606	A. Becker House	Single Dwelling	Greek Revival	4.1 miles
LAK0000706	R. E. Allison House	Single Dwelling	Greek Revival	4.9 miles
LAK0000806	Green & Hoose Cold Storage	Warehouse	Vernacular	2.9 miles
LAK0001006	Depot	Rail Related	Vernacular	3.2 miles
LAK0001107	Dist. School #12 & High School	School	Second Renaissance Revival	5.0 miles
LAK0001206	J. Gibbs House	Single Dwelling	Vernacular	3.8 miles
LAK0004307[b]	Addison Kimball House	Singe Dwelling	Federal	5.0 miles
LAK0004407[b]	William Lyman House	Single Dwelling	Vernacular	4.6 miles
LAK0004507[b]	Francis Ensign Fuller House	Single Dwelling	Italianate	4.6 miles
LAK0004607[b]	James Dayton House	Single Dwelling	Vernacular	4.5 miles
LAK0004707[b]	George Damon House	Single Dwelling	Greek Revival	4.6 miles
LAK0004807[b]	George Pease House	Single Dwelling	Greek Revival	4.8 miles
LAK0004907[b]	Lemuel Kimball II House	Single Dwelling	Italianate	4.9 miles
LAK0005007[b]	Albert DeHeck House	Single Dwelling	Stick	4.9 miles
LAK0005107[b]	James Dayton House II	Single Dwelling	Second Empire/Mansard	5.0 miles
LAK0005207[b]	Solomon Kimball House	Single Dwelling	Vernacular	5.0 miles
LAK0005307[b]	Alpha Charles Childs House	Single Dwelling	Italianate	5.1 miles
LAK0005407[b]	Robertus Childs House	Single Dwelling	Federal	5.1 miles
LAK0005507[b]	Edwin Ware House	Single Dwelling	Federal	5.1 miles
LAK0005607[b]	Rev Harlan Metcalf House	Single Dwelling	Italianate	5.1 miles
LAK0005707[b]	Cyrus J. Ingersoll House	Single Dwelling	Greek Revival	5.11 miles
LAK0005807[b]	Francis Hendry House	Single Dwelling	Italianate	5.1 miles

(OMS-OHC 2022b)

a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.

b. NRHP listed.

Attachment 2

L-22-112

Table 2 - Historic Structures Entries within 6-miles of PNPP (Page 2 of 5)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0005907[b]	Jane Gilbert House	Single Dwelling	Vernacular	5.2 miles
LAK0006007[b]	H. Gill House	Single Dwelling	Italianate	5.4 miles
LAK0006107[b]	Joseph Talcott House	Single Dwelling	Federal	5.5 miles
LAK0006207[b]	George D. Wilson House	Single Dwelling	Greek Revival	5.5 miles
LAK0006407[b]	John Kellogg House & Barn	Single Dwelling	Greek Revival	5.4 miles
LAK0006507[b]	David Smead House	Single Dwelling	Italianate	5.6 miles
LAK0006607[b]	Charles Gilbreath House	Single Dwelling	Vernacular	5.3 miles
LAK0006707[b]	Selby Orland House	Single Dwelling	Federal	5.9 miles
LAK0006807[b]	N/A	Single Dwelling	Vernacular	5.3 miles
LAK0006907[b]	NY Chicago & St. Louis Freight	Rail Related	Eastlake	5.3 miles
LAK0007007[b]	John J. Jones House	Single Dwelling	Italianate	5.2 miles
LAK0007107[b]	Cheese-vat Factory	Mill/Processing/ Manufacturing Facility	Commercial Chicago Style	5.2 miles
LAK0008904	J. C. Huntington Estate	Park/Arena/ Field	Vernacular	5.2 miles
LAK0014407	W.H. Judd House	Single Dwelling	Greek Revival	4.8 miles
LAK0014607	Buehner House	Single Dwelling	Vernacular	3.3 miles
LAK0014804	Warren's Store	Service Station	Vernacular	4.7 miles
LAK0014904	Barto House	Single Dwelling	Vernacular	5.2 miles
LAK0015004	Storrs & Harrison Nursery	Single Dwelling	Vernacular	5.0 miles
LAK0015104	Frank Heckathorn House	Single Dwelling	Vernacular	4.8 miles
LAK0015204	N/A	Single Dwelling	Bungalow	4.8 miles
LAK0015304	Mary Starr House	Single Dwelling	Vernacular	4.7 miles
LAK0015404	R. Marshall House	Single Dwelling	Italianate	4.7 miles
LAK0015504	Paul Lincoln House	Single Dwelling	Vernacular	4.6 miles
LAK0015604	James Lincoln House	Single Dwelling	Craftsman/Arts and Crafts	4.6 miles

(OMS-OHC 2022b)

a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.

b. NRHP listed.

Attachment 2
L-22-112
Table 2 - Historic Structures Entries within 6-miles of PNPP (Page 3 of 5)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0005907[b]	Jane Gilbert House	Single Dwelling	Vernacular	5.2 miles
LAK0006007[b]	H. Gill House	Single Dwelling	Italianate	5.4 miles
LAK0006107[b]	Joseph Talcott House	Single Dwelling	Federal	5.5 miles
LAK0006207[b]	George D. Wilson House	Single Dwelling	Greek Revival	5.5 miles
LAK0006407[b]	John Kellogg House & Barn	Single Dwelling	Greek Revival	5.4 miles
LAK0006507[b]	David Smead House	Single Dwelling	Italianate	5.6 miles
LAK0006607[b]	Charles Gilbreath House	Single Dwelling	Vernacular	5.3 miles
LAK0006707[b]	Selby Orland House	Single Dwelling	Federal	5.9 miles
LAK0006807[b]	N/A	Single Dwelling	Vernacular	5.3 miles
LAK0006907[b]	NY Chicago & St. Louis Freight	Rail Related	Eastlake	5.3 miles
LAK0007007[b]	John J. Jones House	Single Dwelling	Italianate	5.2 miles
LAK0007107[b]	Cheese-vat Factory	Mill/Processing/ Manufacturing Facility	Commercial Chicago Style	5.2 miles
LAK0008904	J. C. Huntington Estate	Park/Arena/ Field	Vernacular	5.2 miles
LAK0014407	W.H. Judd House	Single Dwelling	Greek Revival	4.8 miles
LAK0014607	Buehner House	Single Dwelling	Vernacular	3.3 miles
LAK0014804	Warren's Store	Service Station	Vernacular	4.7 miles
LAK0014904	Barto House	Single Dwelling	Vernacular	5.2 miles
LAK0015004	Storrs & Harrison Nursery	Single Dwelling	Vernacular	5.0 miles
LAK0015104	Frank Heckathorn House	Single Dwelling	Vernacular	4.8 miles
LAK0015204	N/A	Single Dwelling	Bungalow	4.8 miles
LAK0015304	Mary Starr House	Single Dwelling	Vernacular	4.7 miles
LAK0015404	R. Marshall House	Single Dwelling	Italianate	4.7 miles
LAK0015504	Paul Lincoln House	Single Dwelling	Vernacular	4.6 miles
LAK0015604	James Lincoln House	Single Dwelling	Craftsman/Arts and Crafts	4.6 miles

(OMS-OHC 2022b)
a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.
b. NRHP listed.

Attachment 2
L-22-112
Table 2 - Historic Structures Entries within 6-miles of PNPP (Page 4 of 5)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0015704	N/A	Single Dwelling	Vernacular	4.6 miles
LAK0015804	N/A	Single Dwelling	Vernacular	4.5 miles
LAK0015904	J. B. Breed Dairy Farm	Barn	Vernacular	4.3 miles
LAK0016006	S. H. Hull House	Single Dwelling	Vernacular	3.4 miles
LAK0016106	Robert Castler House	Single Dwelling	Vernacular	3.1 miles
LAK0016206	G.A. Fitz House	Single Dwelling	Vernacular	3.1 miles
LAK0016306	George West House	Single Dwelling	Vernacular	2.8 miles
LAK0016406	Harry Few Farm	Single Dwelling	Vernacular	2.5 miles
LAK0016506	N/A	Single Dwelling	Vernacular	2.5 miles
LAK0016606	School No. 1	School	Vernacular	2.3 miles
LAK0016706	Coolidge House	Single Dwelling	Queen Anne	2.3 miles
LAK0016806	Barkalow Farm	Single Dwelling	Italianate	2.2 miles
LAK0016906	N/A	Single Dwelling	Vernacular	2.2 miles
LAK0017006	Stockham/Barkalow Farm	Single Dwelling	Vernacular	2.2 miles
LAK0017106	Old Tavern Farm	Single Dwelling	Vernacular	2 miles
LAK0017206	James Cook House	Single Dwelling	Vernacular	1.9 miles
LAK0017306	N/A	Single Dwelling	Craftsman/Arts and Crafts	1.8 miles
LAK0017406	Disciples Parsonage	Rectory/ Parsonage	Vernacular	1.8 miles
LAK0017506	Barkalow House	Single Dwelling	Vernacular	1.6 miles
LAK0017606	Stevens House	Single Dwelling	Vernacular	1.6 miles
LAK0017706	Lapham House	Single Dwelling	Vernacular	1.5 miles
LAK0017806	N/A	Single Dwelling	Dutch Colonial Revival	1.5 miles
LAK0017906	Ridgeway Lunch	Road/Vehicle Related	Vernacular	1.5 miles
LAK0018006	V. R. Wilcox House	Single Dwelling	Vernacular	1.4 miles
LAK0018106	Elizabeth Parks (House)	Single Dwelling	Vernacular	1.4 miles
LAK0018206	E. W. Beker House	Single Dwelling	Vernacular	1.4 miles
LAK0018306	N/A	Single Dwelling	Vernacular	1.3 miles

(OMS-OHC 2022b)
a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.
b. NRHP listed.

Attachment 2
L-22-112
Table 2 - Historic Structures Entries within 6-miles of PNPP (Page 5 of 5)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0018406	Chapman House	Single Dwelling	Vernacular	1.2 miles
LAK0018506	Graya House	Single Dwelling	Vernacular	1.2 miles
LAK0018606	J. A. Whiting House	Single Dwelling	Greek Revival	1.2 miles
LAK0018706	Zora Bennett House	Single Dwelling	Italianate	1.2 miles
LAK0018806	Perry House	Single Dwelling	Italianate	1.2 miles
LAK0018906	Metroparks	Mill/Processing/ Manufacturing Facility	"Style not Discernable from OHI form"	1.2 miles
LAK0019006	Hurobut House	Single Dwelling	Vernacular	1.3 miles
LAK0019106	J. Whiting House	Single Dwelling	Vernacular	1.4 miles
LAK0019206	Browen Farm	Single Dwelling	Vernacular	1.5 miles
LAK0019306	L. Barkalow House	Single Dwelling	Vernacular	1.5 miles
LAK0019406	George G. Hoyt House	Single Dwelling	Greek Revival	1.6 miles
LAK0019506	Clyde Hull Farm	Single Dwelling	Vernacular	1.6 miles
LAK0019606	N/A	Single Dwelling	Vernacular	1.6 miles
LAK0019706	N/A	Single Dwelling	Craftsman/Arts and Crafts	1.6 miles
LAK0019806	N/A	Single Dwelling	Bungalow	1.6 miles
LAK0019906	Residence	Single Dwelling	Vernacular	1.6 miles
LAK0020006	A. W. Seith Farm	Single Dwelling	Vernacular	1.8 miles
LAK0020106	Seith Farm	Single Dwelling	Vernacular	1.8 miles
LAK0020206	P. Hawkins Farms	Single Dwelling	Vernacular	1.9 miles
LAK0020306	L.S. Haines House	Single Dwelling	Greek Revival	2.0 miles
LAK0031007	N/A	Single Dwelling	Italianate	3.6 miles
LAK0037607	Vanderveer Farm	Single Dwelling	Italianate	3.2 miles
LAK0038406	N/A	Single Dwelling	"No Academic Style-Vernacular	3.7 miles
LAK0038506	Tip Top Motel	Hotel/Inn/Motel	N/A	3.6 miles
LAK0038606	Limberlost Lodge/Motel	Hotel/Inn/Motel	N/A	3.7 miles

(OMS-OHC 2022b)
a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.
b. NRHP listed.

Attachment 3

L-22-112

Table 3 - Cemeteries within 6-miles of PNPP (Page 1 of 1)

OGSI ID#	Quadrangle	Site Type	NRHP Status
6311	Thompson	Northeast Leroy-Clague Farm Cemetery	Protected by State burial laws
6316	Madison	Fairview Memorial Park-Madison Village-River Street Cemetery	Protected by State burial laws
6317	Madison	Northridge-Fuller Farm Cemetery	Protected by State burial laws
6318	Madison	Middle Ridge-Genung Corners Cemetery	Protected by State burial laws
6319	Madison	North Madison Cemetery	Protected by State burial laws
6321	Madison	South Ridge-Tisdel/Antisdel-Pioneer Cemetery	Protected by State burial laws
6340	Thompson	Lemuel Ellis-River Road-Orcutt Cemetery	Protected by State burial laws
6341	Painesville	Lane Road-Perry South Ridge-South Ridge-Perry-Wright Farm Cemetery	Protected by State burial laws
6342	Perry	Parmly/Parmly-Ronke Cemetery	Protected by State burial laws
6343	Perry	Perry Township-Perry Center-Disciple-Perry Cemetery	Protected by State burial laws
6344	Perry	Narrows Road Cemetery	Protected by State burial laws
14350	Madison	Isham-Dayton Road Cemetery	Protected by State burial laws
14351	Madison	Centerville Cemetery	Protected by State burial laws
15688	Thompson	Palmer Cemetery	Protected by State burial laws
15693	Madison	First Congregational Church Cemetery	Protected by State burial laws
15694	Madison	Brewster Cemetery	Protected by State burial laws
15695	Perry	Samuel Huntington Family Cemetery	Protected by State burial laws
15697	Madison	Turneys Corners Cemetery	Protected by State burial laws
15698	Madison	W.T. Baster Family Cemetery	Protected by State burial laws
15702	Madison	Mayers Woods Cemetery	Protected by State burial laws
15703	Perry	Call Road Cemetery	Protected by State burial laws

(OMS-OHC 2022b)

Attachment 4

L-22-112

Table 4 - National Register of Historic Places (NRHP) Properties within 6-Miles of PNPP (Page 1 of 2)

Resource Name NRHP listing	County	Quadrangle	NRHP Listed	Distance from PNPP[(a)]
Lemuel Kimball (II) House 74001540	Lake	Madison	10/15/1974	4.9 miles
Indian Point Fort 74001543	Lake	Painesville	07/30/1974	4.9 miles
Addison Kimball House 75001449	Lake	Madison	03/27/1975	5.0 miles
David R. Paige House 75001450	Lake	Madison	12/23/1975	5.3 miles
Dr. J. C. Winans House 76001461	Lake	Madison	10/20/1980	5.4 miles
Lucius & Corrilla Green House 76001462	Lake	Perry	07/12/1976	2.9 miles
Ladd's Tavern 78002091	Lake	Madison	05/22/1978	3.7 miles
Madison Seminary and Home 79001871	Lake	Madison	02/29/1979	5.1 miles
Judge Abraham Tappan House 79001874	Lake	Madison	05/08/1979	4.8 miles
Brick Vernacular House No.1 80003108	Lake	Madison	10/20/1980	5.3 miles
Brick Vernacular House No. 2 80003109	Lake	Madison	10/20/1980	5.3 miles
Cheese-vat Factory 80003110	Lake	Madison	10/20/1980	5.3 miles
Alpha Charles Childs House 80003111	Lake	Madison	10/20/1980	5.1 miles
Robertus W. Childs House 80003112	Lake	Madison	10/20/1980	5.1 miles
George Damon House 80003113	Lake	Madison	10/20/1980	4.6 miles
James Dayton House 8003114	Lake	Madison	10/20/1980	5.1 miles
James Dayton House II 80003115	Lake	Madison	10/20/1980	5.0 miles
Albert DeHeck House 80003116	Lake	Madison	10/20/1980	4.9 miles
Francis Ensign Fuller House 80003117	Lake	Madison	10/20/1980	4.6 miles

(OMS-OHC 2022b)

a. Distances are approximate and based on the PNPP unit one center point and NRHP location data.

Attachment 4

L-22-112

Table 4 - NRHP Properties within 6-Miles of PNPP (Page 2 of 2)

Resource Name NRHP listing	County	Quadrangle	NRHP Listed	Distance from PNPP[a]
Jane Gilbert House 80003118	Lake	Madison	10/20/1980	5.2 miles
H. Gill House 80003119	Lake	Madison	10/20/1980	5.4 miles
Francis Hendry House 80003120	Lake	Madison	10/20/1980	5.1 miles
Cyrus J. Ingersoll House 80003121	Lake	Madison	10/20/1980	5.1 miles
John J. Jones House 80003122	Lake	Madison	10/20/1980	5.2 miles
John Kellogg House and Barn 80003123	Lake	Madison	10/20/1980	5.5 miles
Solomon Kimball House 80003124	Lake	Madison	10/20/1980	5.0 miles
William Lyman House 80003125	Lake	Madison	10/20/1980	4.7 miles
Rev. Harlan Metcalf House 80003126	Lake	Madison	10/20/1980	5.1 miles
Norfolk and Western Freight Station 80003127	Lake	Madison	10/20/1980	5.3 miles
George Pease House 80003128	Lake	Madison	10/20/1980	4.8 miles
Orland Selby House 80003129	Lake	Madison	10/20/1980	5.9 miles
David Smead House 80003130	Lake	Madison	10/20/1980	5.6 miles
Joseph Talcott House 80003131	Lake	Madison	10/20/1980	5.5 miles
Edwin L. Ware House 80003132	Lake	Madison	10/20/1980	5.1 miles
George D. Wilson House 80003133	Lake	Madison	10/20/1980	5.5 miles
Town Center District with 12 contributing properties 80004247	Lake	Madison	10/20/1980	5.3 miles
Mr. & Mrs. Karl A Staley House 14000042	Lake	Madison	03/4/2014	4.7 miles

(OMS-OHC 2022b)

a. Distances are approximate and based on the PNPP unit one center point and NRHP location data.

Attachment 5
L-22-112
Table Sources

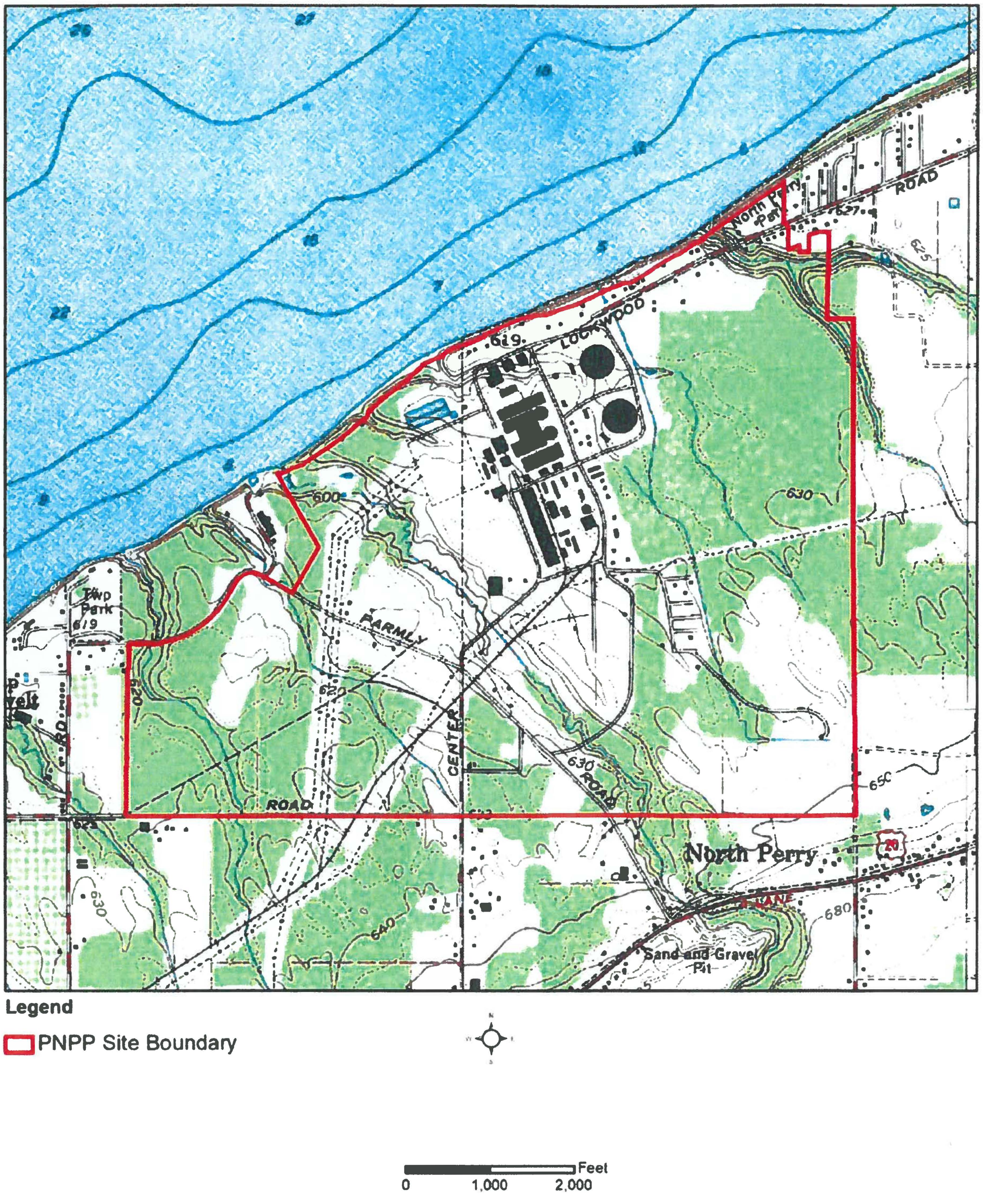
1. Online Mapping System-Ohio History Connection (OMS-OHC) 2022a. Comprehensive Data SHPO and Restricted Archaeological Sites. Retrieved from:

   < https://www.ohiohistory.org/preserve/state-historic-preservation-office/mapping > (Accessed February 23, 2022).

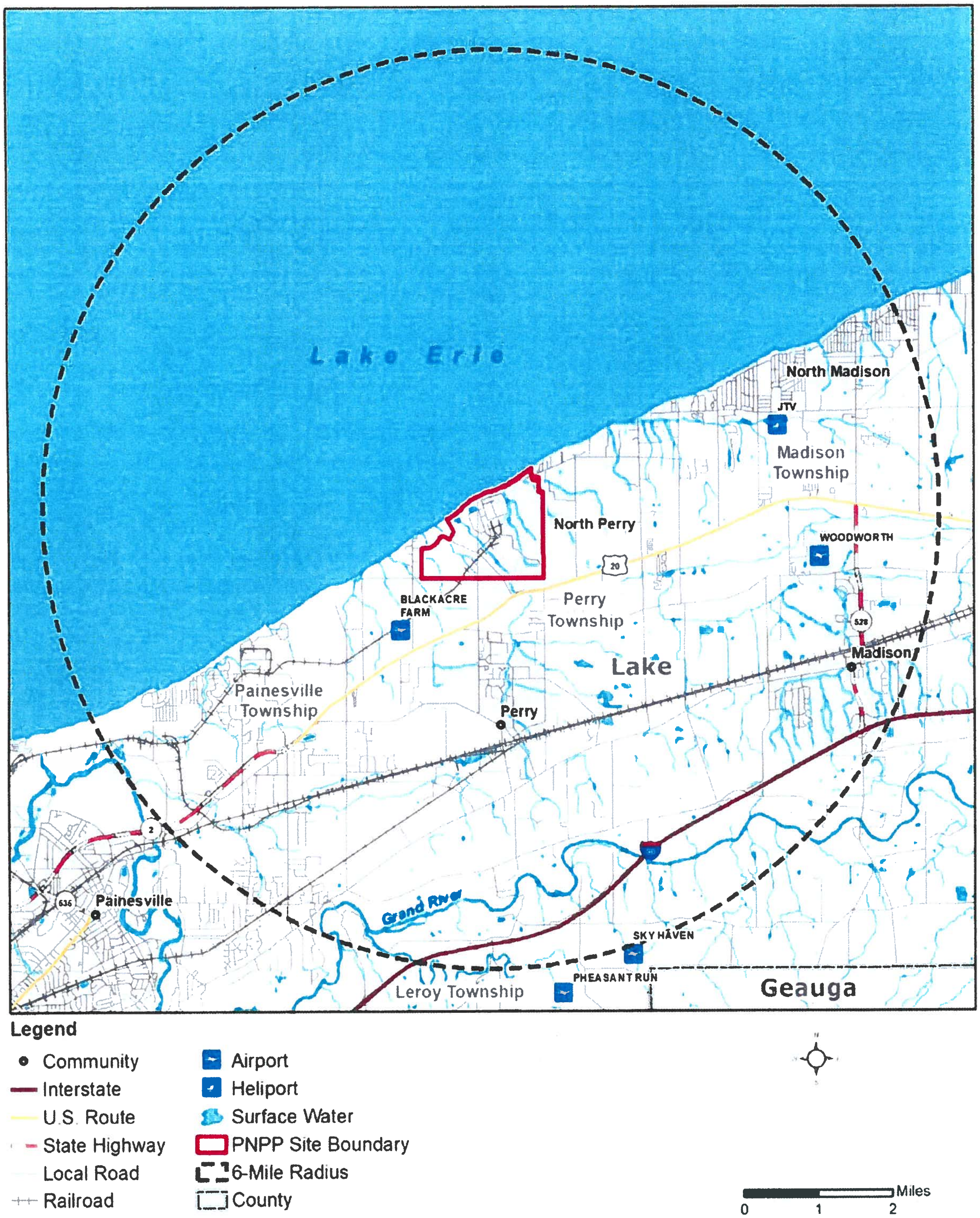
2. Online Mapping System-Ohio History Connection (OMS-OHC) 2022b. SHPO unrestricted data. Retrieved from:

   < https://www.ohiohistory.org/preserve/state-historic-preservation-office/mapping > (Accessed February 23, 2022).

Attachment 6
L-22-112
Figure 1 - PNPP Site



Attachment 7
L-22-112
Figure 2 - PNPP 6-Mile Vicinity



OHIO HISTORY CONNECTION

In reply, please refer to:
2014-LAK-29621

September 28, 2022

Rod Penfield, Site Vice President
Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, OH 44081

RE: Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan, North Perry, Lake County, Ohio

Dear Mr. Penfield:

This is in response to your correspondence, received on May 20, 2022 and additional information received on September 20, 2022 regarding the proposed undertaking. The comments of the Ohio State Historic Preservation Office (SHPO) are made pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated regulations at 36 CFR Part 800.

Energy Harbor is preparing an application for renewing the operating license for the Perry Nuclear Power Plant Unit 1 (PNPP) for an additional 20 years (2026-2046). As part of the license renewal process, the Nuclear Regulatory Commission (NRC) may request consultation in accordance with Section 106. The purpose of your letter dated May 20, 2022 was to solicit preliminary comments from the Ohio SHPO regarding the effects that license renewal activities may have on historic and cultural resources within the plant's environs.

Please see below our *preliminary comments and recommendations* regarding cultural resources and compliance with Section 106. The Ohio SHPO greatly appreciates the opportunity to comment on the undertaking.

Archaeology: Since the undertaking consists of a license renewal and no ground disturbing activates are planned, the SHPO has no concerns regarding archaeological resources and the undertaking.

History/Architecture: Since Perry Power Plant was constructed in 1974, the Ohio SHPO recommends that a professional meeting the Secretary of the Interior Professional Qualification Standards in Architectural History evaluate the facility for its potential eligibility for listing in the National Register of Historic Places. Please note that the proposed license renewal would have no effect even if historic properties are present within the APE, however this recommendation would be a planning tool for future undertakings at the plant.

If you have questions, you can contact me dwelling@ohiohistory.org or at (614) 298-2000.

Thank you for your cooperation.

Sincerely,

Diana Welling,
Department Head & Deputy State Historic Preservation Officer
for Resource Protection & Review
State Historic Preservation Office

Serial: 1095078

From: Diana Welling <dwelling@ohiohistory.org>
Sent: Thursday, October 13, 2022 4:06 PM
To: Spiesman, Benjamin; Grimm, John; Bensi, Mark J
Subject: [External] RE: Discuss Ohio SHPO Recommendation for Perry Nuclear Power Plant (PNPP)

Great talking with you all this afternoon. Thanks again for reaching out.

To follow up on our discussion, the Ohio SHPO is amending our earlier recommendation from our letter dated 9/28/2022. Based on the additional information provided today, that the built environment of the facility was not constructed until 1985, the Ohio SHPO recommends waiting until the facility reaches 45-50 years of age (2031-2035) before considering evaluating its potential eligibility to the National Register of Historic Places. The National Register generally requires that properties are at least 50 years old before they can qualify for listing.

Please let us know if we can provide any additional information or answer any questions.

Thank you

Diana Welling | Department Head and Deputy State Historic Preservation Officer for Resource Protection & Review
State Historic Preservation Office/Ohio History Connection| 800 E. 17th Ave. Columbus, OH 43211-2474
p. 614.298.2000 | f. 614.298.2037 | dwelling@ohiohistory.org

The Ohio History Connection's mission is to spark discovery of Ohio's stories. Embrace the present, share the past and transform the future.

energy harbor

Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

May 12, 2022
L-22-114

10 CFR 50.51

ATTN: Amanda Terrell
Director
Ohio State Historic Preservation Office
800 East 17th Avenue
Columbus, OH 43211

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan

Dear Ms. Terrell,

Energy Harbor is preparing an application for renewing the operating license for the Perry Nuclear Power Plant Unit 1 (PNPP) for an additional 20 years (see the table below). As part of the process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment to be undertaken to enable the continued operation of the unit. The ER addresses the potential to impact historic and cultural resources including tribal cultural resources on or near the PNPP site.

PNPP Licensing Dates

PNPP Unit	Initial License Expiration Date	License Renewal Expiration Date
Unit 1	November 7, 2026	November 7, 2046

This letter seeks input form the Ohio State Historic Preservation Office (SHPO) regarding such effect in the vicinity of the PNPP.

Also, as part of the renewal process, the NRC may request consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), and the federal Advisory Council on Historic Preservation regulations (36 CFR 800) with your agency regarding the license renewal. The timeframe for the NRC consultation request is anticipated to be within a few months of Energy Harbor's application submittal, currently scheduled for mid-2023.

To facilitate our preparation of the license renewal ER and a smooth consultation by the NRC, we are contacting you early in the application process seeking input regarding the effects that license renewal activities may have on historic and cultural resources within the plant's environs and any questions or additional information necessary for the consultation process.

Figures that depict the plant site boundary and the vicinity within a 6-mile radius of the plant (Figures 1 and 2) and tables of known archaeological sites, historic structures, cemeteries, and National Register of Historic Places (NRHP) properties in the plant's vicinity (Tables 1 through 4) are attached. A brief discussion of the plant and its operations during the renewal period of operation is provided below.

The PNPP is in the village of North Perry in Lake County, Ohio. The site is situated on approximately 1,030 acres on the southern shores of Lake Erie. In accordance with the NRC regulations, the transmission lines within the scope of the license renewal are those located within the PNPP site boundary.

During the license renewal term, Energy Harbor proposes to continue operating the unit as currently operated. There are currently no ground-disturbing activities other than those to maintain existing structures and operations anticipated at the PNPP site during the license renewal period. Currently, Energy Harbor does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process. A review of the Online Mapping System at the Ohio History Connection revealed that there are no cultural resources listed within the plant site. Energy Harbor does not anticipate the continued operation of PNPP to adversely affect the environment or any cultural or historic resources.

As stated earlier, this letter seeks your input on the proposed continued operation of the PNPP on historic and cultural resources, including tribal cultural resources, within the environs of the plant. Please notify us of concerns and any information you believe Energy Harbor should consider in the preparation of the ER. Your input is requested by 6/13/2022. Energy Harbor plans to include this letter and any response you provide in the final ER.

Should you or your staff have any questions or comments, please contact Ben Spiesman at (440) 477-1835 or via email at bspiesman@energyharbor.com.

Sincerely,

Rod L. Penfield

Attachments:

1. Table 1 - Archaeological Sites and DOE listings within 6-miles of the PNPP
2. Table 2 - Historic Structures Entries within 6-miles of the PNPP
3. Table 3 - Cemeteries within 6-miles of the PNPP
4. Table 4 - National Register of Historic Places (NRHP) Properties within 6-miles of the Perry Nuclear Power Plant (PNPP)
5. Table Sources
6. Figure 1. PNPP Site
7. Figure 2. PNPP 6-mile Vicinity

cc: T. Lentz
R. Turney-Work, Enercon Services
S. Burgess, Enercon Services

Attachment 1
L-22-114
Table 1 - Archaeological Sites and DOE listings within 6-miles of the Perry Nuclear Power Plant (PNPP) (Page 1 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0002 NRHP#74001543	Painesville	Prehistoric to Historic period fort	Listed on the NRHP 74001543
LA0003	Painesville	Painesville Village site with unknown Woodland components excavated in 1934	Unassessed
LA0019	Painesville	Unassigned prehistoric lithic scatter (N=16)	Unassessed
LA0020	Perry	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0021	Painesville	Unassigned Prehistoric site based on the reported location of projectile points finds	Unassessed
LA0022	Painesville	Unassigned prehistoric lithic scatter (N=5)	Unassessed Reported destroyed
LA0023	Painesville	Unassigned Archaic site	Unassessed
LA0024	Painesville	Unassigned prehistoric lithic scatter (N=5)	Unassessed Reported destroyed
LA0032	Thompson	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0033	Madison	Unassigned prehistoric lithic scatter (N=8)	Unassessed
LA0034	Thompson	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0035	Thompson	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0043	Madison	Early Woodland Adena point	Unassessed
LA0044	Madison	Isolated find of an unassigned Archaic projectile point	Unassessed
LA0046	Madison	Multicomponent artifact collection with diagnostics from the unknown, Late Archaic, and Early and Late Woodland Periods	Unassessed
LA0055	Madison	Late Archaic artifact collection	Unassessed

(OMS-OHC 2022a)
a. DOE listed

Attachment 1

L-22-114

Table 1 - Archaeological Sites and DOE listings within 6-miles of the PNPP (Page 2 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0059	Perry	Unassigned prehistoric site with an unknown Archaic lithic point	Unassessed
LA0060	Perry	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0061	Perry	Unassigned prehistoric lithic scatter (N=9)	Unassessed
LA0062	Perry	Unassigned prehistoric lithic scatter (N=30)	Unassessed
LA0064	Perry	Multicomponent artifact collection with diagnostics from the Paleoindian, Early to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0065	Madison	Multicomponent artifact collection with diagnostics from the Paleoindian, Early to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0066	Madison	Multicomponent artifact collection with diagnostics from the Late Woodland Period	Unassessed
LA0077	Madison	Multicomponent artifact collection with diagnostics from the Paleoindian, Middle to Late Archaic, and Early to Late Woodland Periods	Unassessed
LA0078	Madison	Multicomponent artifact collection with diagnostic from the, Unknown, Early & Late Archaic, and unknown, Early & Late Woodland Periods	Unassessed
LA0080	Madison	W. T. Baster Family 19th century graveyard	Protected by State burial laws

(OMS-OHC 2022a)

a. DOE listed

Attachment 1

L-22-114

Table 1 - Archaeological Sites and DOE listings within 6-miles of the PNPP (Page 3 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0095	Painesville	Lithic scatter with an Early Woodland point (N=51)	Unassessed
LA0096	Painesville	Unassigned prehistoric lithic scatter (N=19)	Unassessed
LA0097	Madison	Multicomponent site with unassigned prehistoric lithic scatter (N=7) and two fragments of smelting glass	Unassessed
LA0098	Madison	Unassigned prehistoric lithic scatter (N=11)	Unassessed
LA0099	Perry	Unassigned prehistoric lithic scatter (N=5)	Unassessed
LA0100	Perry	Unassigned prehistoric lithic scatter (N=5)	Unassessed
LA0113	Painesville	An unassigned prehistoric cemetery where 23 graves were reportedly removed	Reported destroyed, Unassessed
LA0122	Perry	Late Woodland lithic scatter (N=32)	Unassessed
LA0123	Perry	Unassigned prehistoric lithic scatter with an unknown Archaic point (N=14)	Unassessed
LA0129	Madison	Unassigned prehistoric lithic scatter (N=18)	Unassessed
LA0130	Madison	Unassigned prehistoric lithic scatter (N=18)	Unassessed
LA0137	Perry	Middle Archaic lithic scatter with a St. Albans bifurcate point, debitage, two incomplete bifaces, one flake scraper, and 3 deer bone fragments (tested)	Unassessed Noted as destroyed
LA0138	Perry	Unassigned prehistoric lithic scatter (items not listed), tested	Unassessed No further work recommended

(OMS-OHC 2022a)

a. DOE listed

Attachment 1
L-22-114
Table 1 - Archaeological Sites and DOE listings within 6-miles of the PNPP (Page 4 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0158[a]	Painesville	Multicomponent 1810-1840 cabin site/Late Woodland Village site with features	Recommended potentially eligible, criteria D 1991, DOE 3926
LA0160	Perry	Late Woodland site with fire pits, a house feature, pottery, animal bone, lithic tools, debitage, and floral remains N=4,221	Unassessed
LA0165	Painesville	The reported location of a Late Woodland to Late Prehistoric cemetery	Unassessed
LA0170	Painesville	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0171	Perry	19^{th} to early 20^{th} century farmstead with two foundations, a barn and scatter of domestic refuse (N=9)	Unassessed
LA0172	Perry	19^{th} to 20^{th} century domestic debris scatter (N=7)	Unassessed
LA0173	Perry	19^{th} to 20^{th} century domestic debris scatter (N=19)	Unassessed
LA0174	Perry	19^{th} to 20^{th} century domestic debris scatter (N=8)	Unassessed (Removed from State Registry)
LA0175	Perry	Unassigned prehistoric lithic scatter (N=5) and the Possible 1854 Parmely Family Cemetery	Prehistoric unassessed 19^{th} century cemetery is protected by State burial laws
LA0176	Perry	Unassigned prehistoric lithic scatter (N=3)	Unassessed
LA0177	Perry	Unassigned prehistoric lithic scatter (N=1)	Unassessed

(OMS-OHC 2022a)
a. DOE listed

Attachment 1
L-22-114
Table 1 - Archaeological Sites within 6-miles of the PNPP (Page 5 of 5)

OAI ID#	Quadrangle	Site Type	NRHP Status
LA0181	Madison	19th to 20th century domestic debris scatter from a farmstead	Unassessed
LA0182	Madison	A mid-20th century concrete capped water well,	Unassessed
LA0183	Madison	Unassigned lithic scatter with an unknown Woodland ceramic sherd (N=80)	Unassessed
LA0184	Madison	Unassigned non-aboriginal surface domestic trash scatter	Unassessed
LA0185	Madison	Non-aboriginal surface domestic refuse scatter circa 1880 to 1929	Unassessed
LA0196	Painesville	Unassigned prehistoric lithic scatter (N=4)	Unassessed
LA0197	Painesville	Isolated find of a single flake	Unassessed
LA0219	Offshore	ESCO#Allegheny/King Coal shipwreck 1970	"No National Register potential"
LA0220	Offshore	Red Bird shipwreck from prior to 1903	"No National Register potential"
LA0221	Offshore	Charles B. Hill/Delaware shipwreck	"No National Register potential"
LA0225	Perry	Mid-20th century refuse and architectural debris scatter (N=8)	Unassessed
LA0226	Perry	1930 to 1960 surface scatter of domestic refuse (N=8)	Unassessed
LA0227	Perry	Two solarized glass vessel fragments with a manufacture date from 1870 to 1914	Unassessed No further work recommended
LA0228	Perry	Isolated find of a Late Archaic projectile point base	Unassessed
DOE 2352[a]		Cobblestone House	Determined eligible

(OMS-OHC 2022a)
a. DOE listed

Attachment 2

L-22-114

Table 2 - Historic Structures Entries within 6-miles of the PNPP (Page 1 of 4)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0000407[b]	Dr. J. C. Winan House	Single Dwelling	Eastlake	5.3 miles
LAK0000506	J. Mcvitty House	Single Dwelling	Queen Anne	2.9 miles
LAK0000606	A. Becker House	Single Dwelling	Greek Revival	4.1 miles
LAK0000706	R. E. Allison House	Single Dwelling	Greek Revival	4.9 miles
LAK0000806	Green & Hoose Cold Storage	Warehouse	Vernacular	2.9 miles
LAK0001006	Depot	Rail Related	Vernacular	3.2 miles
LAK0001107	Dist. School #12 & High School	School	Second Renaissance Revival	5.0 miles
LAK0001206	J. Gibbs House	Single Dwelling	Vernacular	3.8 miles
LAK0004307[b]	Addison Kimball House	Singe Dwelling	Federal	5.0 miles
LAK0004407[b]	William Lyman House	Single Dwelling	Vernacular	4.6 miles
LAK0004507[b]	Francis Ensign Fuller House	Single Dwelling	Italianate	4.6 miles
LAK0004607[b]	James Dayton House	Single Dwelling	Vernacular	4.5 miles
LAK0004707[b]	George Damon House	Single Dwelling	Greek Revival	4.6 miles
LAK0004807[b]	George Pease House	Single Dwelling	Greek Revival	4.8 miles
LAK0004907[b]	Lemuel Kimball II House	Single Dwelling	Italianate	4.9 miles
LAK0005007[b]	Albert DeHeck House	Single Dwelling	Stick	4.9 miles
LAK0005107[b]	James Dayton House II	Single Dwelling	Second Empire/Mansard	5.0 miles
LAK0005207[b]	Solomon Kimball House	Single Dwelling	Vernacular	5.0 miles
LAK0005307[b]	Alpha Charles Childs House	Single Dwelling	Italianate	5.1 miles
LAK0005407[b]	Robertus Childs House	Single Dwelling	Federal	5.1 miles
LAK0005507[b]	Edwin Ware House	Single Dwelling	Federal	5.1 miles
LAK0005607[b]	Rev Harlan Metcalf House	Single Dwelling	Italianate	5.1 miles
LAK0005707[b]	Cyrus J. Ingersoll House	Single Dwelling	Greek Revival	5.11 miles
LAK0005807[b]	Francis Hendry House	Single Dwelling	Italianate	5.1 miles

(OMS-OHC 2022b)

a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.

b. NRHP listed

Attachment 2

L-22-114

Table 2 - Historic Structures Entries within 6-miles of the PNPP (Page 2 of 4)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0005907[b]	Jane Gilbert House	Single Dwelling	Vernacular	5.2 miles
LAK0006007[b]	H. Gill House	Single Dwelling	Italianate	5.4 miles
LAK0006107[b]	Joseph Talcott House	Single Dwelling	Federal	5.5 miles
LAK0006207[b]	George D. Wilson House	Single Dwelling	Greek Revival	5.5 miles
LAK0006407[b]	John Kellogg House & Barn	Single Dwelling	Greek Revival	5.4 miles
LAK0006507[b]	David Smead House	Single Dwelling	Italianate	5.6 miles
LAK0006607[b]	Charles Gilbreath House	Single Dwelling	Vernacular	5.3 miles
LAK0006707[b]	Selby Orland House	Single Dwelling	Federal	5.9 miles
LAK0006807[b]	N/A	Single Dwelling	Vernacular	5.3 miles
LAK0006907[b]	NY Chicago & St. Louis Freight	Rail Related	Eastlake	5.3 miles
LAK0007007[b]	John J. Jones House	Single Dwelling	Italianate	5.2 miles
LAK0007107[b]	Cheese-vat Factory	Mill/Processing/ Manufacturing Facility	Commercial Chicago Style	5.2 miles
LAK0008904	J. C. Huntington Estate	Park/Arena/ Field	Vernacular	5.2 miles
LAK0014407	W.H. Judd House	Single Dwelling	Greek Revival	4.8 miles
LAK0014607	Buehner House	Single Dwelling	Vernacular	3.3 miles
LAK0014804	Warren's Store	Service Station	Vernacular	4.7 miles
LAK0014904	Barto House	Single Dwelling	Vernacular	5.2 miles
LAK0015004	Storrs & Harrison Nursery	Single Dwelling	Vernacular	5.0 miles
LAK0015104	Frank Heckathorn House	Single Dwelling	Vernacular	4.8 miles
LAK0015204	N/A	Single Dwelling	Bungalow	4.8 miles
LAK0015304	Mary Starr House	Single Dwelling	Vernacular	4.7 miles
LAK0015404	R. Marshall House	Single Dwelling	Italianate	4.7 miles
LAK0015504	Paul Lincoln House	Single Dwelling	Vernacular	4.6 miles
LAK0015604	James Lincoln House	Single Dwelling	Craftsman/Arts and Crafts	4.6 miles

(OMS-OHC 2022b)

a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.

b. NRHP listed.

Attachment 2

L-22-114

Table 2 - Historic Structures Entries within 6-miles of the PNPP (Page 3 of 4)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0015704	N/A	Single Dwelling	Vernacular	4.6 miles
LAK0015804	N/A	Single Dwelling	Vernacular	4.5 miles
LAK0015904	J. B. Breed Dairy Farm	Barn	Vernacular	4.3 miles
LAK0016006	S. H. Hull House	Single Dwelling	Vernacular	3.4 miles
LAK0016106	Robert Castler House	Single Dwelling	Vernacular	3.1 miles
LAK0016206	G.A. Fitz House	Single Dwelling	Vernacular	3.1 miles
LAK0016306	George West House	Single Dwelling	Vernacular	2.8 miles
LAK0016406	Harry Few Farm	Single Dwelling	Vernacular	2.5 miles
LAK0016506	N/A	Single Dwelling	Vernacular	2.5 miles
LAK0016606	School No. 1	School	Vernacular	2.3 miles
LAK0016706	Coolidge House	Single Dwelling	Queen Anne	2.3 miles
LAK0016806	Barkalow Farm	Single Dwelling	Italianate	2.2 miles
LAK0016906	N/A	Single Dwelling	Vernacular	2.2 miles
LAK0017006	Stockham/Barkalow Farm	Single Dwelling	Vernacular	2.2 miles
LAK0017106	Old Tavern Farm	Single Dwelling	Vernacular	2 miles
LAK0017206	James Cook House	Single Dwelling	Vernacular	1.9 miles
LAK0017306	N/A	Single Dwelling	Craftsman/Arts and Crafts	1.8 miles
LAK0017406	Disciples Parsonage	Rectory/ Parsonage	Vernacular	1.8 miles
LAK0017506	Barkalow House	Single Dwelling	Vernacular	1.6 miles
LAK0017606	Stevens House	Single Dwelling	Vernacular	1.6 miles
LAK0017706	Lapham House	Single Dwelling	Vernacular	1.5 miles
LAK0017806	N/A	Single Dwelling	Dutch Colonial Revival	1.5 miles
LAK0017906	Ridgeway Lunch	Road/Vehicle Related	Vernacular	1.5 miles
LAK0018006	V. R. Wilcox House	Single Dwelling	Vernacular	1.4 miles
LAK0018106	Elizabeth Parks (House)	Single Dwelling	Vernacular	1.4 miles
LAK0018206	E. W. Beker House	Single Dwelling	Vernacular	1.4 miles
LAK0018306	N/A	Single Dwelling	Vernacular	1.3 miles

(OMS-OHC 2022b)

a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.

b. NRHP listed.

Attachment 2
L-22-114
Table 2 - Historic Structures Entries within 6-miles of the PNPP (Page 4 of 4)

OHI #	Historical Name	Historical Use	Style	Distance from PNPP[a]
LAK0018406	Chapman House	Single Dwelling	Vernacular	1.2 miles
LAK0018506	Graya House	Single Dwelling	Vernacular	1.2 miles
LAK0018606	J. A. Whiting House	Single Dwelling	Greek Revival	1.2 miles
LAK0018706	Zora Bennett House	Single Dwelling	Italianate	1.2 miles
LAK0018806	Perry House	Single Dwelling	Italianate	1.2 miles
LAK0018906	Metroparks	Mill/Processing/ Manufacturing Facility	"Style not Discernable from OHI form"	1.2 miles
LAK0019006	Hurobut House	Single Dwelling	Vernacular	1.3 miles
LAK0019106	J. Whiting House	Single Dwelling	Vernacular	1.4 miles
LAK0019206	Browen Farm	Single Dwelling	Vernacular	1.5 miles
LAK0019306	L. Barkalow House	Single Dwelling	Vernacular	1.5 miles
LAK0019406	George G. Hoyt House	Single Dwelling	Greek Revival	1.6 miles
LAK0019506	Clyde Hull Farm	Single Dwelling	Vernacular	1.6 miles
LAK0019606	N/A	Single Dwelling	Vernacular	1.6 miles
LAK0019706	N/A	Single Dwelling	Craftsman/Arts and Crafts	1.6 miles
LAK0019806	N/A	Single Dwelling	Bungalow	1.6 miles
LAK0019906	Residence	Single Dwelling	Vernacular	1.6 miles
LAK0020006	A. W. Seith Farm	Single Dwelling	Vernacular	1.8 miles
LAK0020106	Seith Farm	Single Dwelling	Vernacular	1.8 miles
LAK0020206	P. Hawkins Farms	Single Dwelling	Vernacular	1.9 miles
LAK0020306	L.S. Haines House	Single Dwelling	Greek Revival	2.0 miles
LAK0031007	N/A	Single Dwelling	Italianate	3.6 miles
LAK0037607	Vanderveer Farm	Single Dwelling	Italianate	3.2 miles
LAK0038406	N/A	Single Dwelling	"No Academic Style-Vernacular	3.7 miles
LAK0038506	Tip Top Motel	Hotel/Inn/Motel	N/A	3.6 miles
LAK0038606	Limberlost Lodge/Motel	Hotel/Inn/Motel	N/A	3.7 miles

(OMS-OHC 2022b)
a. Distances are approximate and based on the PNPP unit one center point and OMS-OHC location data.
b. NRHP listed.

Attachment 3

L-22-114

Table 3 - Cemeteries within 6-miles of the PNPP (Page 1 of 1)

OGSI ID#	Quadrangle	Site Type	NRHP Status
6311	Thompson	Northeast Leroy-Clague Farm Cemetery	Protected by State burial laws
6316	Madison	Fairview Memorial Park-Madison Village-River Street Cemetery	Protected by State burial laws
6317	Madison	Northridge-Fuller Farm Cemetery	Protected by State burial laws
6318	Madison	Middle Ridge-Genung Corners Cemetery	Protected by State burial laws
6319	Madison	North Madison Cemetery	Protected by State burial laws
6321	Madison	South Ridge-Tisdel/Antisdel-Pioneer Cemetery	Protected by State burial laws
6340	Thompson	Lemuel Ellis-River Road-Orcutt Cemetery	Protected by State burial laws
6341	Painesville	Lane Road-Perry South Ridge-South Ridge-Perry-Wright Farm Cemetery	Protected by State burial laws
6342	Perry	Parmly/Parmly-Ronke Cemetery	Protected by State burial laws
6343	Perry	Perry Township-Perry Center-Disciple-Perry Cemetery	Protected by State burial laws
6344	Perry	Narrows Road Cemetery	Protected by State burial laws
14350	Madison	Isham-Dayton Road Cemetery	Protected by State burial laws
14351	Madison	Centerville Cemetery	Protected by State burial laws
15688	Thompson	Palmer Cemetery	Protected by State burial laws
15693	Madison	First Congregational Church Cemetery	Protected by State burial laws
15694	Madison	Brewster Cemetery	Protected by State burial laws
15695	Perry	Samuel Huntington Family Cemetery	Protected by State burial laws
15697	Madison	Turneys Corners Cemetery	Protected by State burial laws
15698	Madison	W.T. Baster Family Cemetery	Protected by State burial laws
15702	Madison	Mayers Woods Cemetery	Protected by State burial laws
15703	Perry	Call Road Cemetery	Protected by State burial laws

(OMS-OHC 2022b)

Attachment 4

L-22-114

Table 4 - National Register of Historic Places (NRHP) Properties within 6-Miles of the PNPP (Page 1 of 2)

Resource Name NRHP listing	County	Quadrangle	NRHP Listed	Distance from PNPP[a]
Lemuel Kimball (II) House 74001540	Lake	Madison	10/15/1974	4.9 miles
Indian Point Fort 74001543	Lake	Painesville	07/30/1974	4.9 miles
Addison Kimball House 75001449	Lake	Madison	03/27/1975	5.0 miles
David R. Paige House 75001450	Lake	Madison	12/23/1975	5.3 miles
Dr. J. C. Winans House 76001461	Lake	Madison	10/20/1980	5.4 miles
Lucius & Corrilla Green House 76001462	Lake	Perry	07/12/1976	2.9 miles
Ladd's Tavern 78002091	Lake	Madison	05/22/1978	3.7 miles
Madison Seminary and Home 79001871	Lake	Madison	02/29/1979	5.1 miles
Judge Abraham Tappan House 79001874	Lake	Madison	05/08/1979	4.8 miles
Brick Vernacular House No.1 80003108	Lake	Madison	10/20/1980	5.3 miles
Brick Vernacular House No. 2 80003109	Lake	Madison	10/20/1980	5.3 miles
Cheese-vat Factory 80003110	Lake	Madison	10/20/1980	5.3 miles
Alpha Charles Childs House 80003111	Lake	Madison	10/20/1980	5.1 miles
Robertus W. Childs House 80003112	Lake	Madison	10/20/1980	5.1 miles
George Damon House 80003113	Lake	Madison	10/20/1980	4.6 miles
James Dayton House 8003114	Lake	Madison	10/20/1980	5.1 miles
James Dayton House II 80003115	Lake	Madison	10/20/1980	5.0 miles
Albert DeHeck House 80003116	Lake	Madison	10/20/1980	4.9 miles
Francis Ensign Fuller House 80003117	Lake	Madison	10/20/1980	4.6 miles

(OMS-OHC 2022b)

a. Distances are approximate and based on the PNPP unit one center point and NRHP location data.

Attachment 4
L-22-114
Table 4 - NRHP Properties within 6-Miles of the PNPP (Page 2 of 2)

Resource Name NRHP listing	County	Quadrangle	NRHP Listed	Distance from PNPP[(a)]
Jane Gilbert House 80003118	Lake	Madison	10/20/1980	5.2 miles
H. Gill House 80003119	Lake	Madison	10/20/1980	5.4 miles
Francis Hendry House 80003120	Lake	Madison	10/20/1980	5.1 miles
Cyrus J. Ingersoll House 80003121	Lake	Madison	10/20/1980	5.1 miles
John J. Jones House 80003122	Lake	Madison	10/20/1980	5.2 miles
John Kellogg House and Barn 80003123	Lake	Madison	10/20/1980	5.5 miles
Solomon Kimball House 80003124	Lake	Madison	10/20/1980	5.0 miles
William Lyman House 80003125	Lake	Madison	10/20/1980	4.7 miles
Rev. Harlan Metcalf House 80003126	Lake	Madison	10/20/1980	5.1 miles
Norfolk and Western Freight Station 80003127	Lake	Madison	10/20/1980	5.3 miles
George Pease House 80003128	Lake	Madison	10/20/1980	4.8 miles
Orland Selby House 80003129	Lake	Madison	10/20/1980	5.9 miles
David Smead House 80003130	Lake	Madison	10/20/1980	5.6 miles
Joseph Talcott House 80003131	Lake	Madison	10/20/1980	5.5 miles
Edwin L. Ware House 80003132	Lake	Madison	10/20/1980	5.1 miles
George D. Wilson House 80003133	Lake	Madison	10/20/1980	5.5 miles
Town Center District with 12 contributing properties 80004247	Lake	Madison	10/20/1980	5.3 miles
Mr. & Mrs. Karl A Staley House 14000042	Lake	Madison	03/4/2014	4.7 miles

(OMS-OHC 2022b)
a. Distances are approximate and based on the PNPP unit one center point and NRHP location data.

Attachment 5
L-22-114
Table Sources

1. Online Mapping System-Ohio History Connection (OMS-OHC) 2022a. Comprehensive Data SHPO and Restricted Archaeological Sites. Retrieved from:

   https://www.ohiohistory.org/preserve/state-historic-preservation-office/mapping

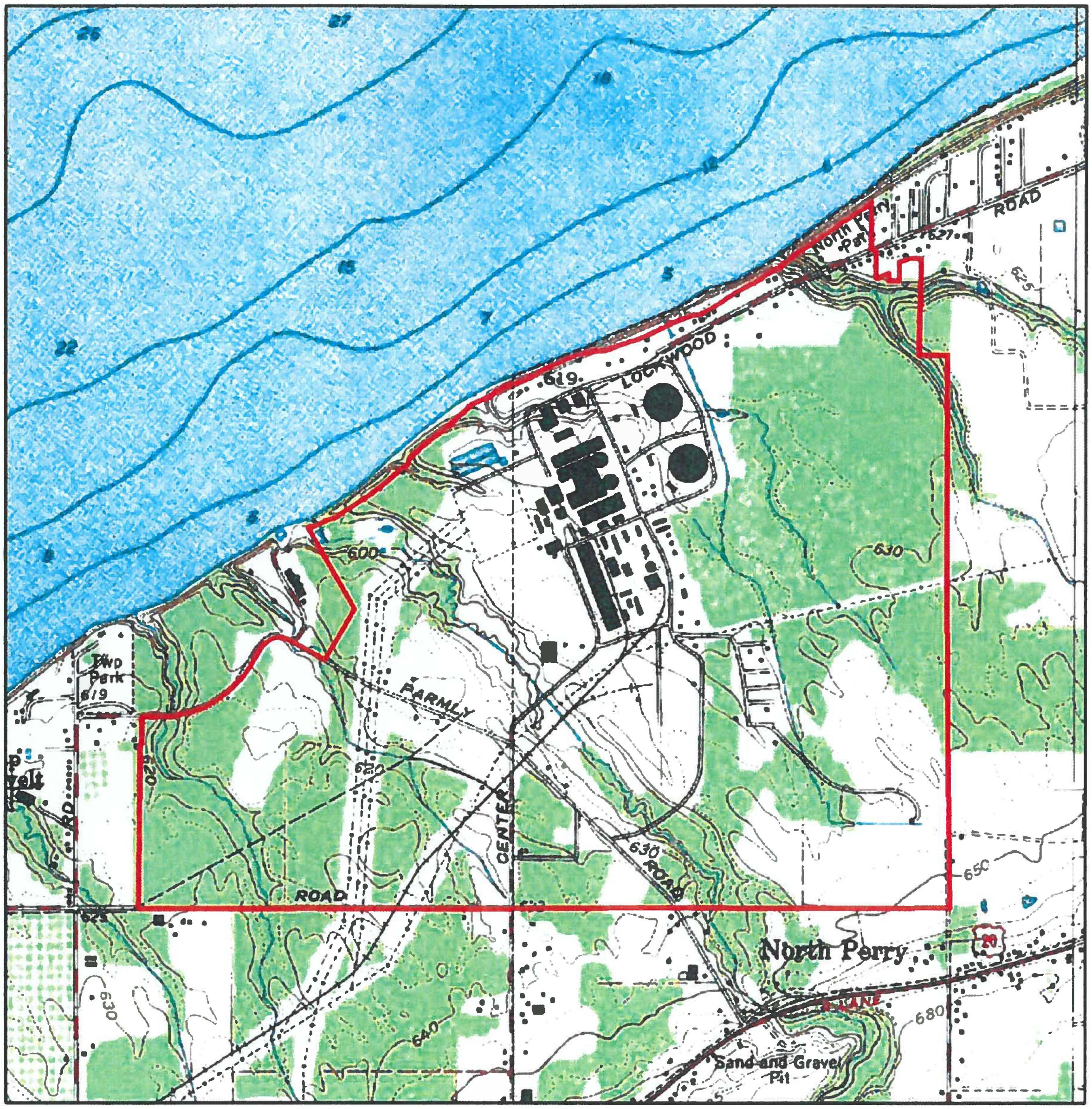
   (Accessed February 23, 2022).

2. Online Mapping System-Ohio History Connection (OMS-OHC) 2022b. SHPO unrestricted data. Retrieved from:

   https://www.ohiohistory.org/preserve/state-historic-preservation-office/mapping

   (Accessed February 23, 2022).

Attachment 6
L-22-114
Figure 1 - PNPP Site

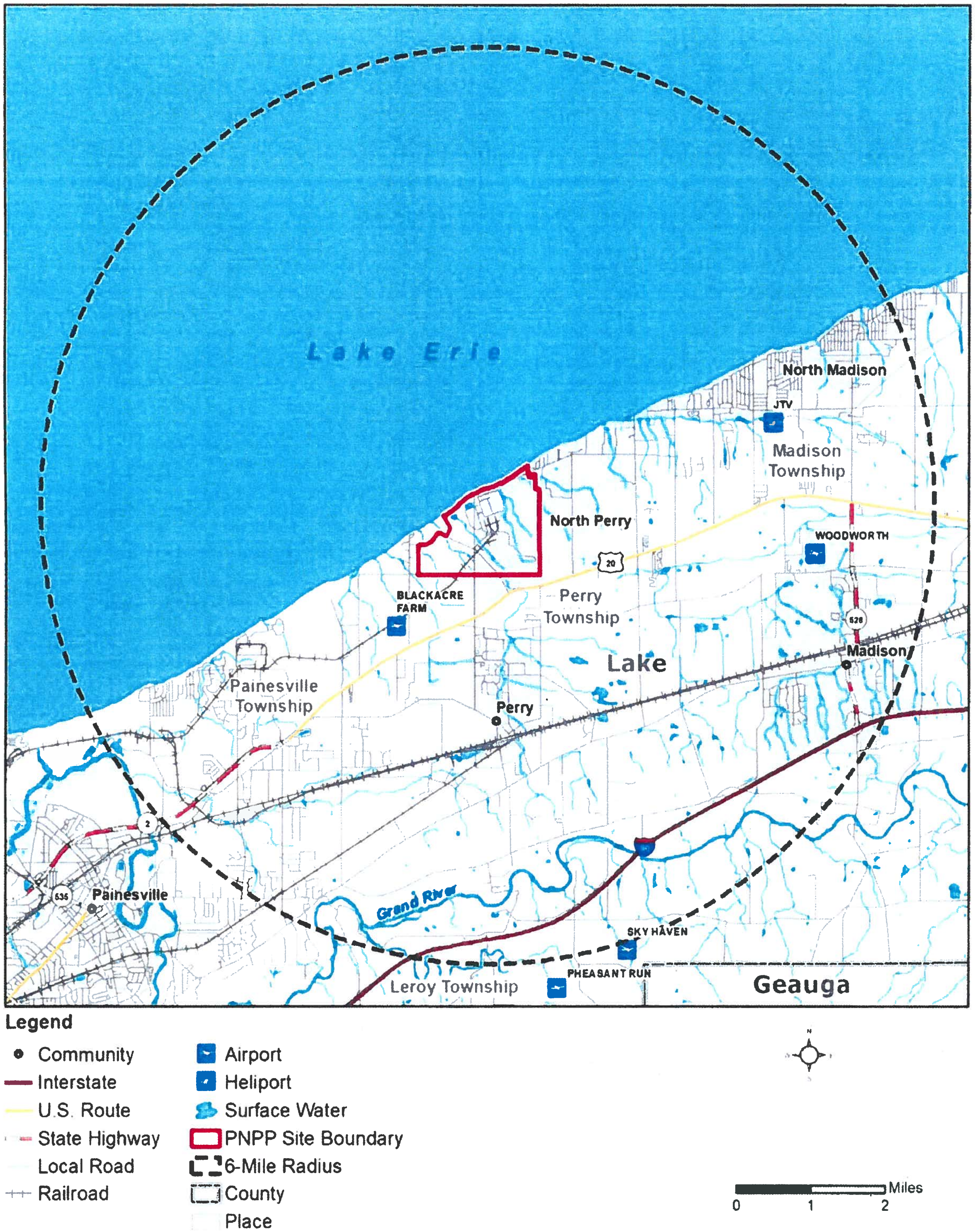


Legend

PNPP Site Boundary

0 1,000 2,000 Feet

Attachment 7
L-22-114
Figure 2 - PNPP 6-Mile Vicinity



As noted in ER Section 9.5.11, Energy Harbor sent consultation letters to Native American groups recognized as potential stakeholders with the opportunity for comment. A list of these recipients is provided below. An example consultation letter sent by Energy Harbor is provided in this attachment, as are all responses received.

Table D-1 List of Native American Group Recipients

Native American Tribe	Name	Title
Hannahville Indian Community, Michigan	Mr. Kenneth Meshigaud	Chairperson
Little Traverse Bay Bands of Odawa Indians, Michigan	Ms. Melissa Wiatrolik	Tribal Historic Preservation Officer
Senaca Nations of Indians	Mr. Joe Stahlman	Seneca-Iroquois Nation Museum/THPO Director
Seneca-Cayuga Nation	Mr. William Tarrant	Tribal Historic Preservation Officer
Miami Tribe of Oklahoma	Ms. Diane Hunter	Tribal Historic Preservation Officer
Eastern Shawnee Tribe of Oklahoma	Mr. Paul Barton	Tribal Historic Preservation Officer

energy harbor

Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

May 17, 2022
L-22-118

10 CFR 50.51

ATTN: Mr. Kenneth Meshigaud
Chairperson
Hannahville Indian Community, Michigan
N14911 Hannahville B1 Road
Wilson, MI 49896

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan

Dear Mr. Meshigaud,

Energy Harbor is preparing an application for renewing the operating license for the Perry Nuclear Power Plant Unit 1 (PNPP) for an additional 20 years (see the table below). This process is known as a "license renewal", and as part of the process the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment to be undertaken to enable the continued operation of the unit.

PNPP Licensing Dates

PNPP Unit	Initial License Expiration Date	License Renewal Expiration Date
Unit 1	November 7, 2026	November 7, 2046

The PNPP is in the village of North Perry in Lake County, Ohio. The site is situated on approximately 1,030 acres on the southern shores of Lake Erie. In accordance with the NRC regulations, the transmission lines within the scope of the license renewal are those located within the PNPP site boundary. Figures that depict the plant site boundary and the vicinity within a 6-mile radius of the plant are attached.

During the license renewal term, Energy Harbor proposes to continue operating the unit as currently operated. There are currently no ground-disturbing activities other than those to maintain existing structures and operations anticipated at the PNPP site during the license renewal period. Energy Harbor does not anticipate any refurbishment because of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process, nor is the continued operation of the PNPP anticipated to adversely affect the environment or any cultural or historic resources.

A review of the Online Mapping System at the Ohio History Perry Connection revealed that there are no cultural resources listed within the 1,030-acre PNPP site.

Energy Harbor is contacting you with the intent of introducing the project and to make available any data you need to ensure an efficient and effective consultation process, and to request the following:

- Input from you regarding tribal cultural resources within the plant's surrounding area, and
- Confirmation from you on our impact assessment associated with the continued operation of the PNPP that due to the absence of ground disturbing activities other than those to maintain existing structures and operations and no refurbishment, there will be no anticipated impacts to tribal cultural resources within the plant's environs.

While environmental impacts of the existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Ohio State Historic Preservation Office (SHPO) and your tribe regarding the license renewal process. Should the NRC consultation take place, the time frame for its conduct is anticipated to be within a few months of Energy Harbor's application submittal, currently scheduled for mid-2023.

To facilitate preparation of the license renewal ER and a smooth consultation by the NRC, we are contacting you early in the application process to request your input as noted above and address any questions you may have associated with the consultation process.

As stated earlier, this letter seeks your input regarding tribal cultural resources within the plant's surrounding area, and confirmation from you that there will be no anticipated impacts to tribal cultural resources within the plant's environs. We appreciate your notifying us of your comments and any information you believe Energy Harbor should consider in the preparation of the ER.

We request that you send your response to Ben Spiesman (see contact information below). Energy Harbor plans to include this letter and any response you provide in the ER.

Ben Spiesman
Energy Harbor
Perry Nuclear Power Plant
Mail Zone PY-A210
10 Center Road
Perry, Ohio 44081

Should you, tribal members, or your staff have any questions or comments, please contact Ben at (440) 477-1835 or via email at bspiesman@energyharbor.com.

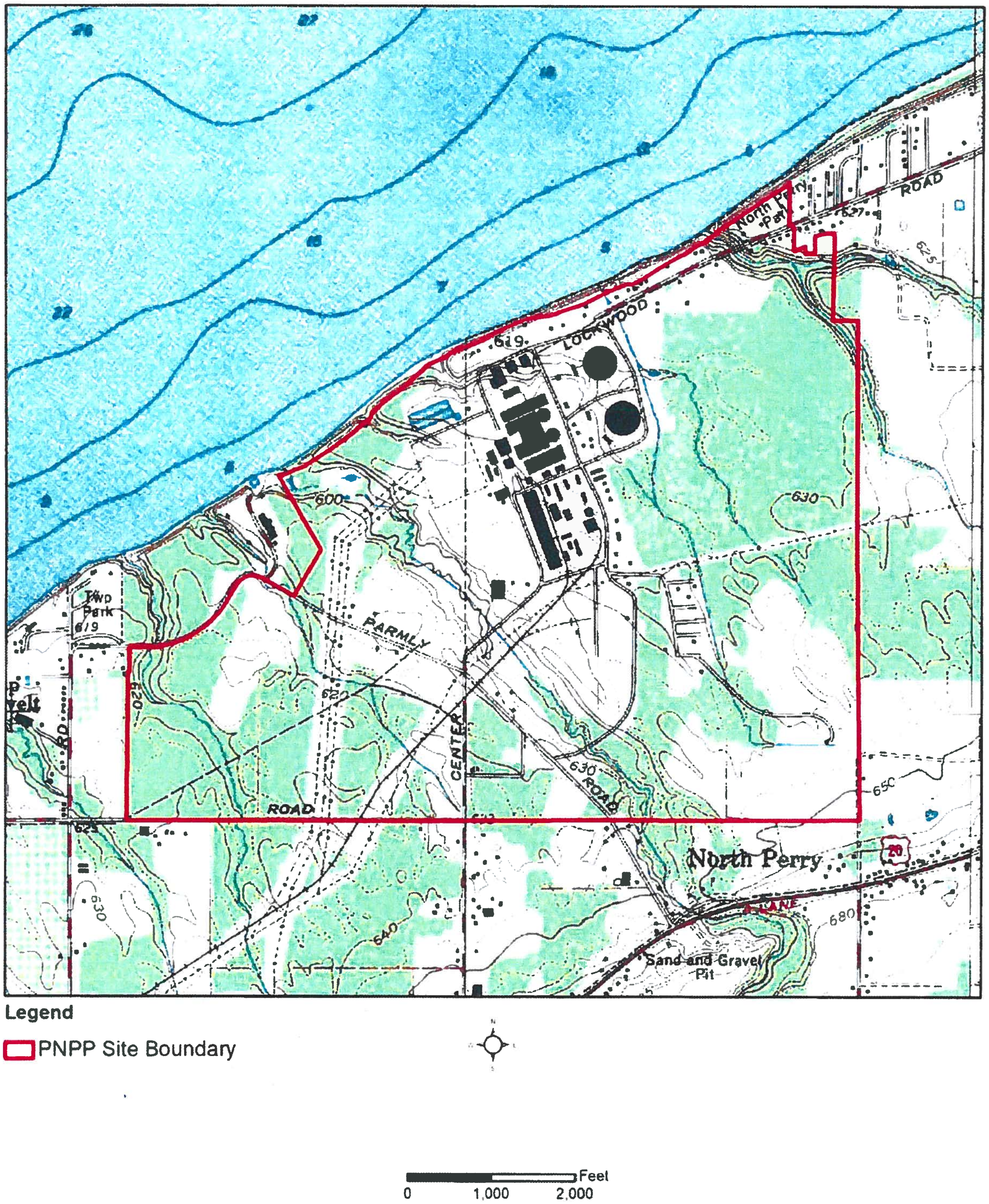
Sincerely,

Rod L. Penfield

Attachments:
1. Figure 1 - PNPP Site
2. Figure 2 - PNPP 6-mile Vicinity

cc: T. Lentz
R. Turney-Work, Enercon Services
S. Burgess, Enercon Services

Attachment 1
L-22-118
Figure 1 - PNPP Site



Attachment 2
L-22-118
Figure 2 - PNPP 6-Mile Vicinity

Attachment E: Other Consultations

energy harbor

Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

May 12, 2022
L-22-117

10 CFR 50.51

ATTN: Mr. Gene Phillips
Bureau of Environmental Health & Radiation Protection
Ohio Department of Health
246 North High Street
Columbus, OH 43215

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan

Dear Mr. Phillips:

Energy Harbor is seeking a response from Ohio Department of Health (ODH) concerning the potential existence and perceived public health risks associated with thermophilic organisms that may be present in the portion of Lake Erie that receives the cooling water discharge from our Perry Nuclear Power Plant (PNPP). Information concerning the reason for this request and the microorganisms of concern is presented below. Figures that depict the plant site boundary and the vicinity within a 6-mile radius of the plant are attached.

Reason for this Request and Microorganisms of Particular Concern
Energy Harbor is preparing an application with the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license for the PNPP Unit 1 for an additional 20 years (see table below).

PNPP Licensing Dates

PNPP Unit	Initial License Expiration Date	License Renewal Expiration Date
Unit 1	November 7, 2026	November 7, 2046

As part of the process, the NRC requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment to be undertaken to enable the continued operation of the unit. The PNPP has a thermal discharge to Lake Erie under NPDES permit No. 31B00016*LD. The presence and numbers of thermophilic organisms can be increased by the addition of heat. Microorganisms of particular concern include several types of bacteria (*Legionella* species, *Salmonella* species, *Shigella* species, and *Pseudomonas aeruginosa*) and the free-living amoeba *Naegleria fowler*).

The PNPP's thermal discharge flows into Lake Erie after cycling through the plant's cooling tower via a discharge tunnel constructed under the lake bed that terminates approximately 1650 feet offshore. The thermal discharge release is through an anchored nozzle on the lake bed approximately 20 feet below the lake's surface which directs the water perpendicularly away from the shoreline to promote rapid mixing of the discharge with the lake. The thermal plume analysis for operation of the plant's cooling system predicted in most cases only a small surface plume within the 1°F isotherm. During the summer months of 2018-2022, the daily temperature in the discharge to Lake Erie averaged in the 70s°F and 80s°F. The maximum daily discharge temperature occurred in August 2021 and was 91°F.

Legionella exposure from operation of the PNPP's cooling tower does not pose a public health hazard. PNPP's operating cooling tower is 516-feet tall and is located within the plant's protected area fence. The cooling tower is not accessible to the public. Procedures for PNPP staff for cooling tower maintenance and inspections require the workers to wear respiratory protection.

Energy Harbor does not anticipate the continued operation of PNPP to adversely affect the environment or public health as a result of microbiological hazards. We are seeking ODH concurrence with Energy Harbor's conclusion that the continued operation of PNPP for the extended license term (license renewal) would not be expected to adversely affect the environment or public health from exposure to thermophilic pathogens in Lake Erie.

We appreciate your consideration of this request and look forward to a response preferably by 6/13/2022, if possible. Energy Harbor plans to include this letter and any response you provide in the final ER that will be submitted as part of the license renewal application to the NRC.

Should you or your staff have any questions concerning this transmittal, please contact Ben Spiesman at (440)-477-1835 or via email at bspiesman@energyharbor.com

Sincerely,

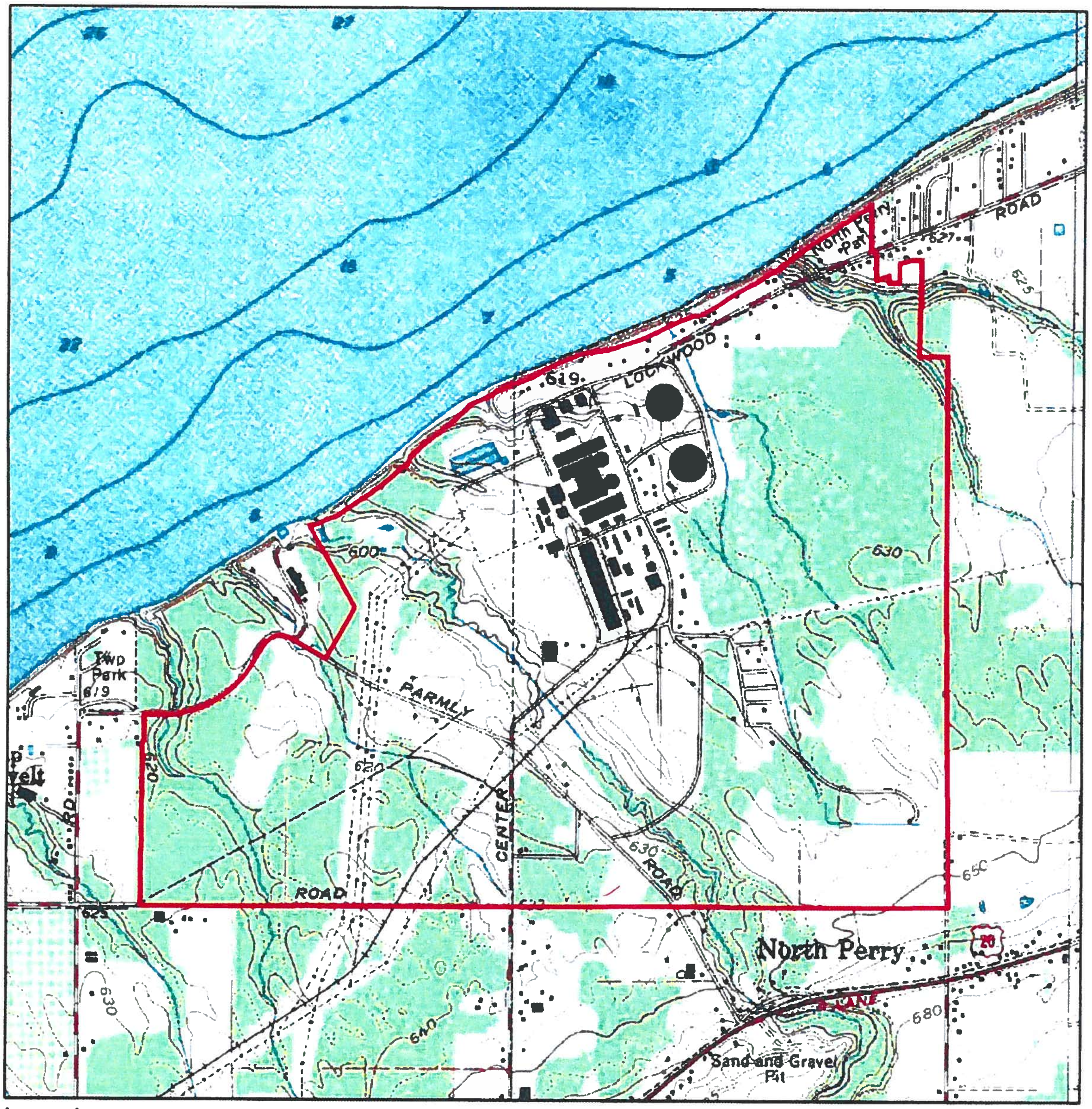
Rod L. Penfield

Attachments:

1. Figure 1 - PNPP Site
2. Figure 2 - PNPP 6-mile Vicinity

cc: T. Lentz
R. Turney-Work, Enercon Services
S. Burgess, Enercon Services

Attachment 1
L-22-117
Figure 1 - PNPP Site



Legend

PNPP Site Boundary

0 1,000 2,000 Feet

Attachment 2

L-22-117

Figure 2 - PNPP 6-Mile Vicinity

Ohio Department of Health

Mike DeWine, Governor
Jon Husted, Lt.Governor

Bruce Vanderhoff, MD, MBA, Director

March 13, 2023

John Grimm
Energy Harbor
Perry Nuclear Power Plant
10 Center Road
Perry, Ohio 44081

Dear Mr. Grimm,

Ohio Department of Health (ODH) staff has completed the requested review of the information provided by Energy Harbor concerning potential public health risks associated with thermophilic organisms that may be present in Lake Erie due to cooling water discharge from the Perry Nuclear Power Plant (PNPP). This review was requested as part of the license renewal process for the PNPP.

Based on the information submitted, ODH does not expect that continued operation of PNPP will adversely affect the environment or public health from thermophilic organisms that may be present in Lake Erie due to cooling water discharge from the PNPP.

While only one plant is constructed and operational, the modeling that was submitted considered impacts from two plants. ODH suggests consideration be given to updating the model used to evaluate potential impacts since the existing model was developed approximately forty years ago.

If you have any additional questions please contact Gene Phillips, Chief, Bureau of Environmental Health and Radiation Protection. Mr. Phillips can be reached at Gene.Phillips@odh.ohio.gov.

Sincerely,

Bruce Vanderhoff, M.D. by LDH

Bruce Vanderhoff, MD, MBA
Director of Health

Attachment F: CZMA Certification

energy harbor

Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Rod L. Penfield
Site Vice President, Perry Nuclear

440-280-5382

June 30, 2022
L-22-133

10 CFR 50.51

Mr. Steven J. Holland, MPA
Consistency Coordinator
Office of Coastal Management
Ohio Department of Natural Resources
105 West Sandusky Shoreline Drive
Sandusky, OH 44870

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Energy Harbor – Perry Nuclear Power Plant Unit 1 License Renewal Plan
Request for Certification

Dear Mr. Holland:

Energy Harbor (EH) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license for the Perry Nuclear Power Plant (PNPP). The plant is currently licensed to operate until November 7, 2026. If approved by the NRC, the renewal term would be for an additional 20 years beyond the original license expiration date to November 2, 2046.

The Federal Coastal Zone Management Act (16 USC 1451, et seq.) imposes requirements on an applicant for a federal license to conduct an activity that could affect a state's coastal zone. The Act requires an applicant to certify to the licensing agency that the proposed action would be consistent with the state's federally approved coastal zone management program. The Act also requires the applicant to provide to the state a copy of the certification statement and requires the state, at the earliest practicable time, to notify the federal agency and the applicant whether the state concurs with, or objects to, the consistency certification (16 USC 1456(c)(3)(A)).

Therefore, this letter regards the Federal Consistency Certification associated with the PNPP License Renewal application to the U.S. Nuclear Regulatory Commission. The proposed project lies within Ohio's designated coastal zone; to obtain a federal permit, applicants are required to certify consistency with the Ohio Coastal Management Program, which is administered by the Ohio Department of Natural Resources (ODNR) Office of Coastal Management.

By contacting you early in the application process, Energy Harbor wishes to identify any potential issues that need to be addressed or information that your office may require to expedite its concurrence. Attachment 1 provides the completed Ohio Coastal Management Program Consistency Certification Statement form.

The PNPP is located on the southern shore of Lake Erie in Lake County, Ohio (See Attachment 2, PNPP 50-mile Radius Map). Coordinates for the station are 41° 48' 04.2" north latitude and 81° 08' 36.6" west longitude. The PNPP property consists of approximately 1,030 acres with the generating facilities occupying approximately 250 acres in the upper (northern) part of the site. These facilities include the power block buildings (e.g., reactor building, auxiliary building, control complex, fuel handling building, turbine building), switchyard, cooling towers, independent spent fuel storage facility, warehouses, and office buildings (See Attachment 3, PNPP Site Layout). The remainder of the site includes paved roads, paved parking lots, and a mix of forest land, grassland, and old field habitats with some wetlands associated with small stream drainages on the property.

The PNPP was originally designed as a two-unit facility, however, construction on Unit 2 was suspended in 1985 and formally cancelled in 1994. At the time of cancellation, most of the major buildings and structures for Unit 2 had been completed, including the 516-foot-tall (157.28 m) cooling tower.

Energy Harbor has no plans to alter current PNPP operations over the 20-year license renewal period. In addition, maintenance activities necessary to support license renewal would be limited to previously disturbed areas on site. License renewal at the PNPP would require neither the expansion of existing facilities nor additional land disturbance. As a result, Energy Harbor believes that continued operation of the PNPP during the license renewal period would have minimal environmental impacts.

Energy Harbor requests your consideration of possible adverse environmental impacts resulting from continued operation of the PNPP. To ensure we appropriately address any issues you might have, or your confirmation that you have identified none, we ask for your response by July 31, 2022.

The results from this consultation and all environmental impacts evaluated under the license renewal process, will be included in the Environmental Report submitted to the NRC. Energy Harbor's Environmental Report will provide an assessment regarding the probable coastal area effects of PNPP's license renewal.

If you require further information, please feel contact Mr. Ben Spiesman, Energy Harbor at 440-477-1835 or by email bspiesman@energyharbor.com. Please address your response regarding this certification request to Ben at the following address:

Ben Spiesman
Energy Harbor
Perry Nuclear Power Plant
Mail Zone PY-A210
10 Center Road
Perry, Ohio 44081

Sincerely,

Attachments:
1. Ohio Coastal Management Program Consistency Certification Statement
2. PNPP 50-mile Radius Map
3. PNPP Site Layout

cc: T. Lentz
R. Turney-Work, Enercon Services
S. Burgess, Enercon Services

Ohio Coastal Management Program
Consistency Certification Statement

I, Mark J. Bensi, do certify that the proposed activity complies with the enforceable policies of Ohio's approved coastal management program and will be conducted in a manner consistent with such program (16 U.S.C. § 1456 and O.R.C. §1506.03).

Address: 10 Center Road

City: Perry State: Ohio Zip Code: 44081

Telephone Number: (440) 280-6179 (Office) (440) 867-5435 (Mobile)

Email Address: mjbensi@EnergyHarbor.com

Applicant's Signature: [signature] Mark Bensi Date: 6/30/22

Please list all local, State, and Federal permits, licenses, leases, and/or other authorizationsrequired for this project:

1) US Nuclear Regulatory Commission, PNPP Operating License: NPF-58
2) U.S. Department of Transportation, Hazardous Material Shipment License Reg. No. 05042155022D
3) Tennessee Department, Environment and Conservation License to ship radioactive material No. T-OH001-L22
4) EPA/OEPA, Hazardous waste generator registration No. OHD025673518
5) Clean Water Act, Section 401 Ohio EPA ID No. 154766
6) Ohio EPA, NPDES Permit No. 31B00016*LD
7) Ohio EPA, Permit to install and operate air contaminated source(s) No. P0111998
8) Ohio Department of Commerce, Division of State Fire Marshall, Registration of underground storage tanks, Facility #43007657
9) Minor Stream Project US EPA ID No. 144414/USACE File No. 00108

10) Perry Nuclear Power Plant Sanitary Relocation Construction Site Stormwater General Permit No. 3GC12806*AG
11) Halite Non-Extraction Lease between State of Ohio and Energy Harbor Nuclear Generation LLC, File No. HNL-OO-I-LA
12) Submerged Lands Lease between State of Ohio and Energy Harbor Nuclear Generation LLC, File No. SUB-0528-LA

Please submit this signed statement with your Federal agency permit/license application.

For additional information on Federal Consistency reviews, please contact the Ohio Coastal Management Program at coastal.regulatory@dnr.ohio.gov or (419) 626-7980.

Attachment 2
L-22-133
PNPP 50-mile Radius Map

Attachment 3
L-22-133
PNPP Site Layout

Legend

- Protected Area Fence
- Submerged Tunnel
- Railroad
- Buildings/Structures
- Exclusion Area Boundary (EAB)
- PNPP Site Boundary

Feet
0 1,000 2,000

October 19, 2022

Mark J. Bensi
Energy Harbor Nuclear Corp.
10 Center Road
Perry, Ohio 44081

RE: Federal Consistency Review for NRC Operating License NPF-58

Dear Mark:

This letter regards the Federal Consistency Certification submitted with your Nuclear Regulatory Commission license renewal application.

The Coastal Zone Management Act and its corresponding Federal Regulations provide that any federal permit activity affecting any coastal use or resource of a state's designated coastal zone must be conducted in a manner consistent to the maximum extent practicable with the enforceable policies of that state's approved coastal management program. ODNR is the designated state agency under the Ohio Coastal Management Program. As such, ODNR is responsible for concurring with or objecting to Federal Consistency Certifications.

This letter is to inform you that ODNR concurs with your Federal Consistency Certification. No further coordination with this office regarding Federal Consistency is required.

If you have any questions, please feel free to contact me at steve.holland@dnr.ohio.gov or (419) 609-4104.

Sincerely,

Steve Holland

Steven J. Holland, M.P.A.
Coastal Programs Administrator

ec: John Grimm, Energy Harbor Nuclear Corp.
Benjamin Spiesman, Energy Harbor Nuclear Corp.
Scudder D. Mackey, Ph.D., Chief, ODNR Office of Coastal Management
John Kessler, P.E., ODNR Office of Real Estate

Attachment G: Assessment of PNPP SAMAs

G.1 EVALUATION OF PNPP PRA MODEL

G.1.1 PRA Model – Level 1 and Level 2 Analysis

The PNPP Probabilistic Risk Assessment (PRA) model of record, PRA-PY1-AL-R01 and supporting documentation have been maintained as a living program, with updates directed every other refueling cycle (approximately every four years) to reflect the as-built, as-operated plant. Interim updates may be prepared and issued in between regularly scheduled model updates on an as needed basis. Typically, an interim revision would be used for an update that would cause a change in Core Damage Frequency (CDF) of greater than 10 percent, a change in Large Early Release Frequency (LERF) of greater than 20 percent, or for changes that could significantly impact a risk informed application. Interim models are also released following focused peer reviews once the associated findings and suggestions have been addressed.

The PRA quantification process used is based on the large-linked fault tree methodology, which is a well-known and accepted methodology in the industry. The model is maintained and quantified using the EPRI Integrated Risk Technologies suite of software programs.

EH employs a multi-faceted, structured approach in establishing and maintaining the technical adequacy and plant fidelity of the PRA models for all EH nuclear generation sites. This approach includes a proceduralized PRA maintenance and update process, as well as the use of self-assessments and independent peer reviews.

The PNPP PRA model and supporting documentation have been maintained as a living program, which is routinely updated in order to reflect the current plant configuration and to reflect the accumulation of additional plant operating history and component data. The latest update to the PNPP PRA occurred on February 10, 2022, with the effective reference model, PRA-PY1-AL-R01 being released at that time.

G.1.2 PRA MODEL – IPEEE ANALYSIS

External hazards were evaluated in the PNPP Individual Plant Examination of External Events (IPEEE) submittal in response to the NRC IPEEE Program (Generic Letter 88-20, Supplement 4) (NRC 1991a). The IPEEE Program was a one-time review of external hazard risk and was limited in its purpose for the identification of potential plant vulnerabilities and the understanding of associated severe accident risks.

The results of the PNPP IPEEE study are documented in the PNPP IPEEE for Severe Accident Vulnerabilities Report submitted to the NRC. Each of the PNPP external event evaluations were reviewed by the NRC and compared to the requirements of NUREG-1407 (NRC 1991b). The NRC transmitted to FirstEnergy Nuclear Operating Company (FENOC), now Energy Harbor, their Staff Evaluation Report of the PNPP IPEEE Submittal on March 9, 2001.

The PNPP PRA is a Level 1 and 2 model that includes internal events and internal floods, as well as seismic events. For external events such as fire, extreme winds and other external events, the risk assessments from the IPEEE can be used for insights.

The PNPP PRA does not include a detailed fire PRA. It relies on the IPEEE fire induced vulnerability evaluation (FIVE) methodology results. The FIVE method applies a systematic approach to identify critical fire areas where fires could fail safety functions and pose an increased risk of core damage if other safety functions are unavailable. The FIVE methodology estimated CDF due to fire is 3.1 E-05/yr, with the dominant risk being fires in the control room, switchgear rooms, and specific elevations of the Control Complex, Fuel Handling, and Turbine Building.

The risk of other external events such as high winds, floods, aircraft accidents, hazardous materials and turbine missiles was assessed in the PNPP IPEEE. The PNPP IPEEE assessments results for these events lead to the conclusions that there are no significant events of concern.

G.1.3 PRA MODEL – PRA MODEL REVISIONS AND PEER REVIEW SUMMARY

The Level 1 and Level 2 PNPP PRA analyses were originally developed in support of Generic Letter 88-20 (NRC 1988), "Individual Plant Examination for Severe Accident Vulnerabilities – 10 CFR 50.54(f)." The PNPP Individual Plant Examination (IPE) and the Individual Plant Examination of External Events (IPEEE) were submitted to the NRC under separate letters in July 1992, and June 1996, respectively. The conclusions of these evaluations did not identify any vulnerabilities; however, a number of insights were gained. Since the inception of these studies, the PRA model has evolved and continues to evolve. Extensive efforts have been applied since the 2008 timeframe to ensure the PRA model satisfies regulatory guide (RG) 1.200 quality requirements (NRC 2009). A summary of the PNPP PRA history (models and peer reviews) are listed below.

Table G1.3-1 PRA Model History Summary

Date	Model	PRA Model Change Description	CDF (/yr)	LERF (/yr)
07/1992	IPE	Individual Plant Examination (IPE) Internal Events and Internal Flooding	1.32E-05	2.04E-06
Model history between IPE and the new model management process directed by NOBP-CC-6001 in 2008 is not provided due to a lack of sufficient detail currently available.				
2/2011	FP-00	Moved model management to new process under NOBP-CC-6001. The model update includes responses to Facts and Observations from 2008 Scientech Peer Review. Addresses problem log items, procedure updates, other modeling refinements. Converted WinNUPRA model to CAFTA Software. Data Update incorporating plant history from 2003 to 2009.	4.29E-06	-
8/2012	FP-0a	Interim Model Update in accordance with NOBP-CC-6001. Incorporation of new LERF/Level 2 model. The model update includes responses to Facts and Observations from recent LERF Focus Scope Peer Review (September 2011). Incorporation of model refinements.	3.93E-06	4.08E-07
1/2013	FP-0b	Interim Model Update in accordance with NOBP-CC-6001. Incorporation of new Internal Flooding modeling. The model update includes responses to Facts and Observations from recent Internal Flood Focus Scope Peer Review (July 2012). Incorporated additional recovery rules and model refinements.	6.66E-06	7.86E-07
1/2013	FP-0c	Documentation Update in accordance with NOBP-CC-6001. Added Attachments A, B and C to QU-001 for Component Master Risk Ranking Spreadsheet. No model changes.	No Change	No Change

Date	Model	PRA Model Change Description	CDF (/yr)	LERF (/yr)
4/2014	FP-01	Full Model Update in accordance with NOBP-CC-6001. Data Update incorporating plant history from 2009 to 2013. Account for recent plant mods and procedure changes, address open gaps, refinement to Internal Flooding model, update, and refinement to human reliability analysis (HRA) Dependency Analysis, other model enhancements.	3.02E-06	1.39E-07
6/2019	AL-R00	Full Model Update in accordance with NOBP-CC-6001. Incorporation of Seismic PRA. Incorporation of flexible coping strategies (FLEX) provisions. The model update includes responses to Facts and Observations from recent Peer Reviews (Seismic Peer Review (October 2014), Offsite Power Recover Focused Scope (July 2015), Focused Scope Peer Review (October 2017), and Facts and Observations (F&O) Closure Workshop (October 2017)). A data update was performed, incorporating plant histories for Cycles 15, 16, and part of 17 (up to 12/31/2017). Gaps in modeling of systems, accident sequences, human reliability analysis, data and initiating events were addressed. Refinement to HRA Dependency Analysis.	1.69E-05	9.61E-06

Date	Model	PRA Model Change Description	CDF (/yr)	LERF (/yr)
2/2022	AL-R01	Full Model Update in accordance with NOBP-CC-6001. Incorporation of Open Phase Condition. Incorporation of Boiling Water Reactors Owners' Group (BWROG) Emergency Procedures and Severe Accident Guidelines (EPG/SAG) Rev 4. A data update was performed, incorporating plant histories for cycle 17 and 18 (up to end of 1R18 4/8/2021). Gaps in modeling of systems, accident sequences, human reliability analysis, data and initiating events were addressed. Account for recent plant mods and procedure changes, update of HRA Dependency Analysis, model refinements.	1.55E-05	9.73E-06

G.1.3.1 Major Differences Between the IPE Model and Model FP-00

- This is the initial model under the new model management process described in NOBP-CC-6001. It is also the first model maintained in the CAFTA software and was the first model issued following the 2008 Scientech Peer Review, and addresses all Findings identified from that Peer Review. Note that the 2008 Peer Review determined that the Technical Elements for Internal Flooding and LERF were not in a condition to be reviewed. Additional Internal Flooding and LERF model updates with supporting Focused Scope Peer Reviews were scheduled following the issuance of this model. Therefore, there is no LERF value associated with this model, and the reported CDF of 4.29E-06/yr is for Internal Events only, with no Internal Flooding or any other hazard.
- In addition to addressing all Findings associated with the 2008 Scientech Peer Review, additional notifications and internally identified gaps were addressed in this update. Data, plant history, plant modifications, and procedure revisions were also reviewed and the PRA model updated accordingly.
- Room heatup calculations were performed to support the inclusion and exclusion of various HVAC and room cooling systems, as appropriate.
- Offsite Power Recovery was adjusted from a fault tree approach to a Recovery Rule approach utilizing the convolution method. Note this was later identified as a PRA Model Upgrade and a Focused Scope Peer Review was performed to address this in July 2015.
- Control rod drive (CRD) + standby liquid control (SLC) alternate injection as an alternative high-pressure injection means prior to performing an emergency depressurization was added to the model, after discussions with plant Operations revealed this was the strategy the plant would take under such conditions.

G.1.3.2 Major Differences Between the Model FP-00 and Model FP-0a

- This model update was an interim model update in accordance with NOBP-CC-6001 and incorporates the LERF/Level 2 model into the Perry PRA model. The LERF/Level 2 model was re-performed with contractor support, and was Peer Reviewed in September 2011. All Findings were addressed subsequent to the release of the PRA model. The reported CDF of 3.93E-06/yr and LERF value of 4.08E-07/yr are for Internal Events only, with no Internal Flooding or any other hazard.
- Basic model refinements and enhancements were performed, including improvements to the recovery rule structure, additions to the mutually exclusive rules, refinements to common cause modeling, and correction of typographical errors in some of the recovery rules.

G.1.3.3 Major Differences Between the Model FP-0a and Model FP-0b

- This model update was an interim model update in accordance with NOBP-CC-6001 and incorporates the Internal Flooding model into the Perry PRA model. The Internal Flooding model was re-performed with contractor support, and was Peer Reviewed in July 2012. All Findings were addressed subsequent to the release of the PRA model. The reported CDF of 6.66E-06/yr and LERF value of 7.86E-07/yr are for Internal Events and Internal Flooding, with no other hazard.
- Minor enhancements to the structure of the Level 2 Event Trees were made.

G.1.3.4 Major Differences Between the Model FP-0b and Model FP-0c

- This update was a Documentation Update only in accordance with NOBP-CC-6001, with additional detail and information (Component Master Risk Ranking spreadsheet) added to the Quantification Notebook. No modeling changes were incorporated and the CDF and LERF values were unchanged.

G.1.3.5 Major Differences Between the Model FP-0c and Model FP-R01

- This update was a full model update in accordance with NOBP-CC-6001. The reported CDF of 3.02E-06/yr and LERF value of 1.39E-07/yr are for Internal Events and Internal Flooding, with no other hazard.
- Data, plant history, plant modifications, and procedure revisions were reviewed, and the PRA model updated accordingly.
- ECP 10-0811-000, Replace Obsolete M23/M24 Flow Control Stations, was incorporated into the PRA which eliminated the instrument air dependency on the M23/M24 HVAC system and removed a significant HFE from the model and resulted in a significant decrease in CDF/LERF.
- A modeling enhancement to take credit for the automatic initiation of Containment Spray was implemented in the model. Previously only credit was taken for manual initiation only and the automatic initiation was assumed to have a negligible impact on risk, however the HRA dependency between the actions for manual initiation of Suppression Pool Cooling and Containment Spray were found to be significant, particularly in the Internal Flooding model. This modeling enhancement also resulted in a significant decrease in CDF/LERF.

- Basic model refinements and enhancements were performed, including improvements to the recovery rule structure and additions to the mutually exclusive rules.
- Improvements and further refinements to the HRA Dependency Analysis were incorporated.

G.1.3.6 Major Differences Between the Model FP-R01 and Model AL-R00

- This model update was a full model update in accordance with NOBP-CC-6001 and incorporates the Seismic model into the Perry PRA model. The Seismic model was developed with contractor support, and was Peer Reviewed in October 2014. Additionally, a Focused Scope Peer Review was performed in July 2015 for the Offsite Power Recovery modeling. An Independent Assessment F&O Closure Workshop was performed in October 2017. Alongside the F&O Closure Workshop, a Focused Scope Peer Review was performed. All Findings were addressed subsequent to the release of the PRA model.
- The reported CDF of 1.69E-05/yr and LERF value of 9.61E-06/yr are for Internal Events, Internal Flooding and Seismic, with no Fire or other hazards. The contribution for Internal Events and Internal Flooding only was 1.25E-06/yr for CDF and 1.47E-07/yr for LERF.
- Data, plant history, plant modifications, and procedure revisions were reviewed, and the PRA model updated accordingly. The data update incorporating new generic priors and recent plant history was found to have a significant reduction in CDF/LERF values.
- FLEX provisions were incorporated into the PRA model, utilizing guidance from NEI 12-06.
- Incorporation of procedure changes reflecting Fukushima insights, mainly preserving RCIC operation and not depressurizing the RPV below the RCIC turbine stall pressure when no other injection source is available, was incorporated into the model. This had a significant reduction in CDF/LERF values.
- Refinements to the Containment Venting model, including splitting out control room and local actions, was added to the model.
- Updated the model to reflect recent procedural changes to not inhibit ADS (outside of ATWS and SBO). This had a significant reduction in CDF/LERF values.
- Updated the model to reflect recent procedural changes regarding SLC injection. This was a time-critical action, and the procedural direction to perform this action was moved to a hardcard. This improved the timing in the HRA and thus improved the overall reliability of this action. This had a significant reduction in LERF values.
- Plant modifications replaced the old air compressors with newer ones. The old compressors required an operator response to manually adjust NCC cooling to the compressors, while the new ones handle this automatically. This removed a significant HFE from the model. This had a significant reduction in CDF/LERF values.
- Additional updates and refinement to the HRA was performed.

G.1.3.7 Major Differences Between the Model AL-R00 and Model AL-R01

- This model update was a full model update in accordance with NOBP-CC-6001. The reported CDF of 1.55E-05/yr and LERF value of 9.73E-06/yr are for Internal Events, Internal Flooding and Seismic, with no Fire or other hazards. The contribution for Internal Events and Internal Flooding only was 1.25E-06/yr for CDF and 1.99E-07/yr for LERF.

- Data, plant history, plant modifications, and procedure revisions were reviewed, and the PRA model updated accordingly. Additional updates and refinement to the HRA was performed.
- Incorporation of the Open Phase Condition was included as new initiating events.
- Incorporation of procedural changes due to the BWROG EPG/SAG Rev 4 guidance.
- Basic model refinements and enhancements were performed, including improvements to the recovery rule structure and additions to the mutually exclusive rules.

Table G1.3-2 PRA Peer Review Summary

Date	PRA Related Event
07/1992	Individual Plant Examination (IPE) NRC submittal
06/1996	Individual Plant Examination – External Events (IPEEE) NRC submittal
07/1996	Re-submittal of Individual Plant Examination – External Events due to identified reproduction errors
05/1997	Boiling Water Reactors Owners' Group (BWROG) Probabilistic Safety Assessment (PSA) Peer Review Certification
05/2008	American Society of Mechanical Engineers (ASME) RA-Sb-2005 PRA Standard Gap Analysis
02/2011	Model update including CAFTA conversion. (Model PRA-PY1-FP-R0)
11/2011	Level 2 \ Large Early Release Frequency RG 1.200 Focused Peer Review to ASME/ANS-RA-Sa-2009 and Reg Guide 1.200, Rev. 2
08/2012	Interim model update to include Level 2 \ LERF with Focused RG 1.200 Peer Review comments addressed. (Model PRA-PY1-FP-R0a)
07/2012	Internal Flooding Focused Scope RG 1.200 Peer Review to ASME/ANS-RA-Sa-2009 and Reg Guide 1.200, Rev. 2
01/2013	Interim model update to include Internal Flooding with Focused RG 1.200 Peer Review comments addressed. (Model PRA-PY1-FP-R0b)
06/2013	Interim model (Model PRA-PY1-FP-R0c) release (administrative release)
04/2014	Full model update incorporating data updates, correction of identified gaps, model enhancements, etc. (Model PRA-PY1-FP-R01)

Date	PRA Related Event
10/2014	Seismic Peer Review to Part 5 of the ASME/ANS PRA Standard RA-Sb-2013
07/2015	Focused Scope Peer Review to specific supporting requirements (SR)s related to the modeling of offsite power recovery, to ASME/ANS PRA Standard RA-Sb-2013
10/2017	Focused Scope Peer Review conducted on all Facts and Observations (F&O) Resolutions determined to be PRA Upgrades
10/2017	F&O Closure Review, conducted on all open F&O Resolutions determined to by PRA Updates, following the guidance and expectations provided in Appendix X of Nuclear Energy Institute (NEI) 05-04, and NEI 12-13, as well as the expectations of the NRC.
06/2019	Full model update incorporating Seismic into the PRA. The update also added diverse and flexible coping strategies (FLEX) and incorporated procedural updates. The update also included a data update and correction of identified gaps. (Model PRA-PY1-AL-R00)
02/2022	Full model update incorporating procedural revisions in response to recent updates to BWROG guidance, and incorporation of an Open Phase Condition as an initiating event. The update also included a data update and correction of identified gaps. (Model PRA-PY1-AL-R01)

G.1.3.8 PRA Model Peer Reviews

All but one F&O from all Peer Reviews have been formally closed out by the 2017 F&O Closure Review. The one F&O stemming from the 2014 Seismic Peer Review was not closed by the peer review closure process. This one Finding was related to Seismic and concerns development of human failure events (HFEs). The independent closure review did not close this F&O as some of the HFEs related to recovery from relay chatter did not have any supporting clear procedural guidance. Discussions with the station had been ongoing, however ultimately the station decided to not implement any proposed procedural guidance to recover from relay chatter. This Finding has therefore been addressed by removing all such relay chatter recovery HFEs from the model, as procedural guidance for these actions has not been developed. This Finding, F&O 15-2, is provided below, along with its resolution.

FACT/OBSERVATION REGARDING PRA. TECHNICAL ELEMENTS
F&O Number: 15-2 Associated Supporting Requirements: Seismic Plant Response (SPR)-B7, SPR-C1, SPR-E2, SPR-B4b
SR is judged to be met but an F&O is written based on conservative assumptions which bias insights such as relative risk significance of SSCs and operator actions. In addition, the conditional core damage probabilities and conditional large early release probabilities are believed to be too high. As the results are refined the insights will change and additional refinements in SFR are expected. FENOC is aware of the conservative bias and was addressing these areas in advance of the peer team arrival onsite. (This F&O originated from SR SPR-E2)
LEVEL OF SIGNIFICANCE (Finding, Suggestion or Best Practice)
Finding
BASIS FOR SIGNIFICANCE
This is a finding because the conservative treatment of the human error probability (HEP) results in the relay chatter events, which are recoverable, being the dominant contributors to the seismic risk. This results in unrealistic conditional core damage probabilities (CCDPs) at low accelerations, and also masks the real insights about seismic contributors and plant capability. Perform a more detailed human reliability analysis (HRA) for the recovery actions for relay chatter or eliminate the need for operator action by replacing susceptible relays with seismically rugged relays.
POSSIBLE RESOLUTION

Perform a more detailed HRA for the recovery actions for relay chatter or eliminate the need for operator action by replacing susceptible relays with seismically rugged relays.
PLANT RESPONSE OR RESOLUTION
Detailed HRA Analysis has been performed for the relay restoration and recovery HEPs. Such HEPs in the final model include: CPHIEOPSPI6-6RCIC-SEISx - Operator fails to recover from reactor core isolation cooling (RCIC) Isolation due to relay chatter, based on guidance in ARI-H13-P601-0021-B2 and EOP-SPI 6.6 CPHIONIR10-2ADS-SEISx - Operator fails to recover from undesired automatic depressurization system (ADS) actuation, based on guidance in ONI-R10-2 These HEPs were developed for Seismic HRA damage bins 1-3, and variations were also developed for combined loss of offsite power (LOOP) and small loss of coolant accident (LOCA) scenarios if there was found to be a significant difference in the time available to recover, based on Modular Accident Analysis Program (MAAP) analysis. Note that HEPs for actions to recover from additional relay chatter scenarios have been drafted, but not incorporated into the final seismic PRA (SPRA) model due to a lack of clear procedural guidance. Resolution of this F&O, alongside similar F&O’s addressing relay fragilities and to further refine HRA has resulted in a reduction in CDF and LERF from these specific contributors. The new HEPs were developed using the same methods used for other Seismic and Internal Events HEPs, and no new methods were introduced. The dominant accident sequences continue to be station blackout and total loss of AC power (TLAC) scenarios. Resolution of this F&O does not constitute a “new methodology or significant changes in scope or capability.”

The PNPP PRA model has addressed all of the applicable F&Os identified in the previous 1997 PNPP PSA PRA Peer Review Certification, the 2008 PRA Standard (2005 revision) Gap Analysis Self-Assessment, the 2011 Focused Large Early Release Frequency Peer Review, the 2012 Focused Internal Flood PRA Peer Review, the 2014 Seismic Peer Review, and the 2015 Focused Scope Offsite Power Recovery Peer Review. The PRA model is considered to be fundamentally compliant with RG 1.200, Revision 2 for the scope of this application and meets Capability Category II or above in the ASME PRA Standard (RA-Sb-2005) (ASME/ANS 2013; NRC 2009). The PRA-PY1-AL-R01 PRA model can support all risk-informed applications requiring Capability Category I or II.

G.1.4 PRA MODEL – LEVEL 3 ANALYSIS

G.1.4.1 Introduction

The PNPP Level 3 analysis was performed using the WinMACCS code (Windows Interface for MACCS2, MELCOR Accident Consequence Code System, Version 3.10.0) (SAND 1998). The Level 3 model, which requires inputs related to site-specific meteorological, population, and economic data in addition to frequency and characteristics of each release category from the Level 2 PRA, estimates the consequences in terms of population dose, offsite economic cost, early fatalities, and late/cancer related fatalities. Risks in terms of population dose risk and offsite economic cost risk were also estimated in this analysis. Risk is defined as the product of specified consequence and frequency of an accidental release.

G.1.4.2 Input

The following sections describe the PNPP site-specific input parameters used to obtain the offsite dose and economic impacts for cost-benefit analyses.

G.1.4.2.1 Projected Total Population

The total population within a 50-mile radius of PNPP was estimated for the year 2046. The 50-mile radius area around the plant was divided into 16 directions that are equivalent to a standard navigational compass rosette. This rosette was further divided into 11 "inner" radial rings, each with 16 azimuthal sections. Part of the inner most ring (0.5-mile radius) is considered to be the exclusion zone without a resident population. The small portion of land shown in the north-west (NW) 50-mile radial zone near Erieau, Ontario Canada (primarily Rondeau Provincial Park) is estimated to have a negligible population and is estimated to be zero for this evaluation.

The SECPOP 4.3.0 algorithm is used for determining the population resident in each segment of each radial annulus using the 2010 Census as the basis year. Further population estimates and projections beyond 2010, including 2020 Census data, have to be pursued outside of SECPOP ("post-processing") as only county data are available, not the census block data relied upon by SECPOP 4.3.0 (USCB 2020).

The population extension to year 2046 is accomplished on a county-by-county basis. The county growth factors were developed for the estimated change in population for the specified counties between years 2010 and 2046. A segment specific growth factor was developed based on the area-weighted growth contribution from each of its component counties.

The county 2010 to 2046 growth factors were developed directly as the 2046 county population estimate divided by the 2010 county population from the 2010 Census (USCB 2020). In this step the Ohio and Pennsylvania projections of future populations by county was prepared as part of the Ohio Department of Development and the Center for Rural Pennsylvania (CRPA 2022; OHDD 2022). The state-based county data reflects data published at the time of analysis.

The county 2010-2046 growth factors are developed directly as the ratio of the county projection for 2046 divided by the county populations from the 2010 Census.

Because the weighting factors are based on real census numbers and because of the limited range of growth, the method of preparing the estimated 2046 segment population growth is considered sufficiently robust.

For each rosette segment, the fraction of its area in each component county was estimated. This was accomplished by reviewing each segment of the 50-mile spatial location rosette and estimating the fraction of that segment that was occupied by a particular county, counties, or water. Each segment's growth factor was then calculated as the sum of the products of each component county area fraction multiplied by that county's 2010-2046 growth factors.

Because of the very small population (<100) in the 0-to 1-mile radial annulus, no attempt was made to estimate growth, and a constant factor of 1.0 was used.

The final year 2046 segment populations were then calculated as the product of the detailed 2010 Census data multiplied by the 2010-2046 individual segment growth factors. Transient population for the 50-mile radius around the PNPP site was not included in this version of the PNPP Level 3 analysis due to the low estimated population increases and was assumed to be negligible.

The total projected population of the 50-mile zone of analysis is 2,304,156. The projected 2046 segment populations are shown in Table G1.4-1, “Projected 2046 Segment Populations Per Segment.” These are the population numbers used for the WinMACCS site INP file.

Table G1.4-1 Projected 2046 Population Projection Per Segment

	0.5 mi	1 mi	2 mi	3 mi	4 mi	5 mi	10 mi	20 mi	30 mi	40 mi	50 mi	Totals (Radial Direction)
N	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	7	63	0	0	0	0	0	0	0	0	70
ENE	0	1	350	456	1896	2014	5526	25606	8763	15310	21819	81,741
E	0	0	4	694	517	1004	4897	14360	5935	5636	13780	46,827
ESE	0	0	205	739	224	1316	2907	7086	5128	9972	16426	44,003
SE	0	95	763	289	101	327	1255	3717	6910	11850	26892	52,199
SSE	0	7	310	358	709	112	1266	5061	11568	26093	122828	168,312
S	0	0	218	1305	182	623	1938	13378	19266	25209	45053	107,172
SSW	0	0	74	471	1020	660	7162	19746	38645	121141	175281	364,200
SW	0	54	11	260	635	2564	28631	72242	271414	481066	358510	1,215,387
WSW	0	0	0	0	0	1841	7200	42893	11113	13338	147860	224,245
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0
Totals (Radial Distance)	0	164	1,998	4,572	5,284	10,461	60,782	204,089	378,742	709,615	928,449	2,304,156

G.1.4.2.2 Land Fraction

SECPOP4.3.0 calculates the land fraction for each rosette section as explained in the manual for the code (NRC 2019). The code contains a county-level database with the land fractions for each county obtained from the 2010 census data files (USCB 2020). The calculated values are used directly in these analyses. Due to the way in which SECPOP4.3.0 allocates population from the census blocks, certain radial blocks near the plant are shown as all water. These segments have zero population so that the effect on the results is not significant.

G.1.4.2.3 Watershed Index and Definitions

Watershed indexes for the PNPP site were developed for this input. Spatial elements are designated as river systems or lake systems. Per NUREG/CR-4551, the designation of lake is only used for very large bodies of water, such as Lake Michigan, which may serve as drinking water sources (NRC 1990b). Lake Erie is inside the 50-mile region. A spatial element that was predominantly Lake Erie was designated a lake system. All other elements were designated river systems. The other lakes around the Perry site are smaller and are expected to behave like river systems. The spatial element designation of a river or lake system was estimated using maps and images of the region.

The watershed definition data was assumed to be the same as the data from the Code Manual for MACCS2 (SAND 1998).

G.1.4.2.4 Regional Economic Data

The regional economic data is calculated by SECPOP4.3.0 from data provided to it in a data file named County2007.dat (NRC 2019). This file was updated (a pre-processing step) to 2017 agricultural census and 2020 census data for the 13 counties that are all or in part within 50 miles of the PNPP site. Approximately 3000 other county data sets in the file for the rest of the United States (US) were left unchanged.

The selected SECPOP4.3.0 regional economic values were updated to 2017 using data from the Bureau of the Census and the Department of Agriculture 2017 Census of Agriculture (USDA 2017).

G.1.4.2.4.1 Region Index

The region indexes were selected to allow unique region numbers for the sectors with large areas, that is, the very small regions of the rosette near the plant were assigned to similar regions. This is required because MACCS2 has a limit of 99 regions only.

G.1.4.2.4.2 Total Annual Farm Sales (ASFP)

The 2017 US Census of Agriculture item market value of agricultural products sold was used to develop the value for annual farm sales per hectare of farmland in each region index (USDA 2017). The 2017 calculated value was used directly for this analysis.

G.1.4.2.4.3 Farmland Property Values (VFRM)

The 2017 US Census of Agriculture (USDA 2017) items estimated market value of land and buildings and estimated market value of all machinery and equipment was used to develop the value for farmland property in dollars per hectare in each region index. The 2017 calculated value was used directly for this analysis.

G.1.4.2.4.4 Non-Farm Property Value (VNFRM)

Non-farm property values for 2020 was calculated using the equations included in the SECPOP4.3.0 manual (NRC 2019). Parameters values were collected from the 2020 US Census for per capita income (county and US), Department of Commerce for reproducible tangible wealth for the US, the US Department of Agriculture for value of farm assets and amount of urban and built-up land in the US, and Federal Reserve economic data on median housing values in the US.

G.1.4.2.4.5 Value of Farm Wealth (VALWF)

The Average farm wealth value has been calculated as the sum of the corresponding non-zero values of Farmland Property Value (VFRM) in the Regional Economic Data block of the SITE file divided by the total number of non-zero regions. This value includes both publicly and privately owned grazing lands, farmland, farm buildings, and non-recoverable farm machinery, as well as any publicly owned infrastructure serving the farm industry. The resulting value is $19,700/hectare.

G.1.4.2.4.6 Value of Non-Farm Wealth (VALWNF)

The Average non-farm wealth value has been calculated as the sum of the corresponding non-zero values of Non-Farmland Property Value (VNFRM) in the Regional Economic Data block of the SITE file divided by the total number of non-zero regions. Nonfarm wealth includes all public and private property not associated with farming that would be unusable if the region was rendered either temporarily or permanently uninhabitable. The resulting value is $390,105/person.

G.1.4.2.4.7 Other Economic Parameters

Economic costs are the recommended MACCS2 values as given for the NUREG-1150 study in NUREG/CR 4551, Vol. 2, Rev. 1., Part 7, updated using recent Consumer Price Indexes from the Bureau of Labor Statistics (NRC 1990b; USBL 2021a). The NUREG-1150 study uses economic values that are based on 1986 annual consumer price index (NRC 1990a). A factor of 2.47, representing cost escalation from 1986 (CPI index of 109.6) through 2021 (CPI index of 271.0) was applied to parameter values describing cost of evacuating and relocating people and decontamination activities.

The average cost of decontamination labor DLBCST ($/Man-year) was obtained from the NUREG/CR-3673, Economic Risks of Nuclear Power Reactor Accidents report (NRC 1984). This value is in terms of 1984 dollars (CPI = 96.5) and is multiplied by a factor of (271.0/96.5 =) 2.81 updated to 2021 dollars (annual CPI = 271.0).

Applying the above CPI factors on the selected MACCS2 CHRONC input data yields the following adjusted Evacuation, Relocation and Decontamination Costs, Table G1.4-2.

Table G1.4-2 Evacuation, Relocation and Decontamination Costs

Parameter	Description	Original Values		Factor	Adjusted 2021 New Values	
EVACST	Daily cost for a person who is evacuated ($/Person-Day)	27.0		2.47	66.7	
RELCST	Daily cost for a person who is relocated ($/Person-Day)	27.0		2.47	66.7	
CDFRM	Cost of farm decontamination per farmland unit area ($/Hectare)	562.5	1250.0	2.47	1389.4	3087.5
CDNFRM	Cost of nonfarm decontamination per resident person ($/Person)	3000.0	8000.0	2.47	7410.0	19760.
POPCST	Population relocation cost ($/Person)	5000.0		2.47	12350.0	
DLBCST	Average Cost of decontamination labor ($/Man-year)	30000.0		2.81	84300.0	

G.1.4.2.5 Agriculture Data

The crop season data taken from the agricultural data available in the 2017 Census of Agriculture was used to produce the land fraction used for each crop (USDA 2017). The recommended values for crop season (beginning [GBEG] and end [GEND]) as discussed in Table 4.2 of NUREG/CR-4551 were used (NRC 1990b).

G.1.4.2.6 Meteorological Data

The WinMACCS model requires meteorological data for wind speed, wind direction, atmospheric stability, accumulated precipitation, and atmospheric mixing heights.

Site meteorological data was obtained from the annual meteorological reports for the PNPP site and were processed into WinMACCS format containing hourly meteorological data for years 2019 through 2021.

The seasonal mixing height data for morning and afternoon mixing heights from 1984 through 1991 (Table G1.4-3) was obtained from the Environmental Protection Agency (EPA) Support

Center for Regulator Atmospheric Modeling (SCRAM) report from 1991, recorded at Wright Patterson Airforce Base (EPA 2022 SCRAM report). The average seasonal mixing height data from the Ohio SCRAM collection site was used as representative data for the PNPP site.

Table G1.4-3 Average Mixing Layer Heights (1984 through 1991)

Season	MACCS2 Morning Input (100 meters)	MACCS2 Afternoon Input (100 meters)
Winter	6	7
Spring	6	13
Summer	4	16
Autumn	5	10

G.1.4.2.7 Emergency Response Assumptions

The emergency evacuation model has been modeled as a single evacuation zone extending out 10 miles from the plant. The average evacuation speed is estimated to be on the order of 3.13 mph (1.4 m/s). For the purposes of this analysis an average evacuation speed of 1.4 m/s is used with a 7200 second delay between the alarm and start of evacuation, with no sheltering for the base case. The base model assumes that 99.5 percent of the people within 10 miles evacuate, and 0.5 percent do not.

G.1.4.2.8 Core Inventory

The core inventory at the time of the accident is based on a plant-specific calculation. The core inventory represents a 24-month cycle design for the core operating at 3758 megawatts thermal (MWt), the current licensed power level. This calculation reflects the anticipated projected fuel management / burnup approach implemented at PNPP. Table G1.4-4 summarizes the estimated PNPP core inventory used in the MACCS2 analysis.

Table G1.4-4 Core Inventory

Nuclide	Activity (Bq)	Nuclide	Activity (Bq)	Nuclide	Activity (Bq)
Co-58	6.57E+18	Ru-103	5.98E+18	Cs-136	2.99E+17
Co-60	6.71E+16	Ru-105	4.23E+18	Cs-137	5.79E+17
Kr-85	5.27E+16	Ru-106	2.43E+18	Ba-139	6.74E+18
Kr-85m	9.36E+17	Rh-105	3.99E+18	Ba-140	6.54E+18
Kr-87	1.78E+18	Sb-127	4.19E+17	La-140	6.95E+18
Kr-88	2.51E+18	Sb-129	1.21E+18	La-141	6.15E+18
Rb-86	9.56E+15	Te-127	4.16E+17	La-142	5.77E+18
Sr-89	3.37E+18	Te-127m	5.63E+16	Ce-141	6.20E+18
Sr-90	4.27E+17	Te-129	1.22E+18	Ce-143	5.68E+18
Sr-91	4.26E+18	Te-129m	1.81E+17	Ce-144	5.10E+18
Sr-92	4.65E+18	Te-131m	5.51E+17	Pr-143	5.50E+18
Y-90	4.45E+17	Te-132	5.35E+18	Nd-147	2.51E+18
Y-91	4.38E+18	I-131	3.77E+18	Np-239	7.81E+19
Y-92	4.67E+18	I-132	5.44E+18	Pu-238	1.86E+16
Y-93	5.46E+18	I-133	7.64E+18	Pu-239	1.79E+15
Zr-95	6.56E+18	I-134	8.37E+18	Pu-240	2.42E+15
Zr-97	6.87E+18	I-135	7.16E+18	Pu-241	7.99E+17
Nb-95	6.61E+18	Xe-133	7.37E+18	Am-241	1.01E+15
Mo-99	7.12E+18	Xe-135	2.68E+18	Cm-242	2.50E+17
Tc-99m	6.21E+18	Cs-134	9.80E+17	Cm-244	1.56E+16

G.1.4.2.9 Source Terms

The source terms release fractions (RELFRC) for the WinMACCS element groups are shown below (Table G1.4-5) for 32 different source term categories (STC). The release fractions are derived from MAAP, which uses slightly different grouping. The MAAP values are given in the PNPP Level 2 Notebook. A brief description of the source term categories are provided in Table G1.4-6.

Table G1.4-5 Source Term Category Release Fractions

STC Designator	Plume No.	Release Fraction (MACCS2 Group)								
		Kr/Xe	I	Cs	Te/Sb	Sr	Ru	La	Ce	Ba
AP	1	1.00E+00	3.00E-01	6.80E-02	5.90E-02	1.90E-03	5.80E-05	8.20E-05	2.70E-04	1.80E-02
(STC-1)	2	2.40E-03	1.80E-02	1.20E-02	9.30E-03	4.70E-04	0.00E+00	5.60E-05	6.20E-04	1.90E-04
	3	8.20E-04	1.80E-02	6.00E-03	9.90E-03	1.90E-06	0.00E+00	6.40E-07	1.50E-05	7.10E-05
BP	1	1.00E+00	9.00E-01	6.90E-01	3.40E-01	5.90E-02	4.90E-04	4.60E-03	2.90E-02	1.90E-01
(STC-2)	2	2.20E-06	8.50E-03	7.60E-03	2.20E-03	2.30E-03	0.00E+00	4.00E-04	7.00E-03	9.50E-04
	3	1.80E-06	1.40E-02	9.70E-02	8.20E-02	1.70E-04	0.00E+00	8.90E-05	1.20E-03	2.40E-04
	4	2.10E-07	3.30E-02	1.50E-02	4.20E-03	1.80E-07	0.00E+00	7.90E-09	1.20E-08	6.20E-05
CA-VF-UNM	1	9.80E-01	2.90E-02	2.60E-02	1.30E-02	5.00E-03	5.80E-05	3.10E-04	7.10E-04	1.90E-02
(STC-3)	2	4.00E-03	6.60E-04	3.00E-04	3.90E-03	2.40E-06	0.00E+00	3.70E-07	9.10E-06	8.10E-06
	3	1.20E-02	2.90E-02	1.50E-02	1.10E-02	1.00E-06	0.00E+00	1.30E-07	2.50E-06	1.60E-04
	4	2.10E-03	1.40E-02	8.40E-03	1.30E-03	4.80E-08	0.00E+00	3.30E-09	2.00E-08	3.10E-05
CI (Leak)	1	1.20E-04	4.50E-08	1.70E-08	2.00E-08	1.30E-08	0.00E+00	2.00E-10	1.20E-09	5.90E-08
(STC-4)	2	9.70E-01	1.50E-04	1.50E-04	1.70E-04	7.90E-04	5.60E-05	3.60E-05	8.50E-05	2.20E-03
	3	3.40E-02	6.40E-03	1.2E-03	4.90E-04	1.30E-03	9.90E-07	1.40E-04	1.90E-04	1.20E-03
	4	2.90E-04	9.10E-03	5.10E-03	1.00E-03	6.10E-06	0.00E+00	6.40E-07	2.50E-06	6.30E-06

STC Designator	Plume No.	Release Fraction (MACCS2 Group)								
		Kr/Xe	I	Cs	Te/Sb	Sr	Ru	La	Ce	Ba
CP-VF-SUP	1	5.70E-01	5.10E-04	5.80E-04	3.30E-04	1.70E-06	9.70E-09	2.20E-08	2.10E-07	2.90E-06
(STC-5)	2	2.80E-01	3.20E-04	2.50E-04	2.90E-04	3.70E-05	2.20E-06	1.60E-06	4.20E-06	2.40E-04
	3	8.20E-02	2.30E-04	5.80E-05	1.10E-04	4.20E-05	0.00E+00	2.40E-06	6.60E-06	1.70E-04
	4	6.00E-02	8.20E-04	1.70E-04	6.80E-05	1.80E-05	9.70E-09	2.20E-06	2.40E-05	7.20E-06
CP-VF-UNM	1	4.80E-02	3.50E-04	2.30E-04	5.90E-06	1.10E-07	0.00E+00	6.50E-10	4.70E-09	4.60E-07
(STC-6)	2	6.60E-01	1.30E-03	3.20E-04	1.20E-03	1.20E-04	6.10E-06	5.50E-06	3.00E-05	8.90E-04
	3	8.20E-02	7.40E-03	1.40E-03	7.70E-04	3.50E-03	7.80E-07	3.80E-04	3.70E-03	1.30E-03
	4	1.90E-02	1.50E-02	3.70E-03	2.30E-03	8.70E-05	0.00E+00	1.40E-05	2.10E-04	7.30E-05
EA-VF-UNH	1	7.00E-02	8.70E-06	3.60E-06	8.10E-06	1.90E-08	1.60E-02	1.10E-09	7.40E-09	5.00E-07
(STC-7)	2	8.20E-01	2.90E-01	8.60E-02	9.50E-02	2.90E-02	0.00E+00	1.80E-02	3.20E-02	5.70E-02
	3	1.10E-01	1.20E-02	3.90E-03	3.90E-03	4.60E-06	0.00E+00	2.20E-06	5.70E-06	3.20E-06
	4	2.40E-03	6.50E-03	1.90E-03	9.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-05
EA-VF-UNM	1	6.60E-02	1.30E-05	1.10E-05	7.30E-06	9.20E-08	0.00E+00	2.90E-09	9.80E-09	4.10E-07
(STC-8)	2	5.40E-01	2.70E-03	1.30E-03	2.50E-04	6.80E-04	1.40E-06	9.30E-05	7.70E-04	2.50E-04
	3	3.90E-01	7.80E-04	1.00E-03	4.20E-04	7.00E-04	0.00E+00	9.90E-05	1.10E-03	3.10E-04
	4	2.10E-03	8.90E-03	6.80E-03	8.00E-03	1.50E-07	0.00E+00	6.50E-09	1.60E-08	8.10E-05

STC Designator	Plume No.	Release Fraction (MACCS2 Group)								
		Kr/Xe	I	Cs	Te/Sb	Sr	Ru	La	Ce	Ba
EI-VF-SPR	1	4.90E-02	2.30E-05	1.20E-05	1.20E-05	1.20E-07	0.00E+00	4.20E-09	1.70E-08	8.50E-07
(STC-9)	2	7.70E-01	3.40E-04	3.20E-04	2.40E-04	3.30E-05	2.80E-07	5.00E-06	7.40E-05	3.50E-05
	3	1.60E-01	5.80E-05	2.40E-04	1.30E-04	1.10E-06	0.00E+00	2.50E-07	4.10E-06	8.70E-06
	4	6.20E-03	1.70E-04	2.00E-04	2.80E-04	9.70E-09	0.00E+00	4.50E-10	8.80E-10	2.70E-06
EI-VF-UNH	1	6.20E-02	5.70E-06	1.90E-06	5.20E-06	6.70E-09	0.00E+00	3.80E-10	2.70E-09	1.80E-07
(STC-10)	2	7.30E-01	5.00E-02	7.00E-03	4.90E-03	1.20E-02	9.70E-03	7.90E-03	1.40E-02	8.30E-03
	3	2.00E-01	1.90E-02	4.70E-03	3.80E-03	2.50E-05	0.00E+00	1.10E-05	3.10E-05	1.60E-05
	4	1.20E-03	1.00E-02	2.60E-03	8.10E-03	1.00E-09	0.00E+00	1.00E-10	1.00E-09	1.50E-05
EI-VF-UNM	1	7.20E-01	8.00E-04	7.40E-04	3.60E-04	2.80E-06	1.90E-08	3.10E-08	3.40E-07	3.30E-06
(STC-11)	2	2.40E-01	3.70E-03	1.80E-03	4.60E-04	1.30E-04	3.50E-06	1.20E-05	8.00E-05	4.20E-04
	3	1.60E-02	4.10E-03	1.30E-03	1.10E-04	2.10E-04	0.00E+00	2.40E-05	2.60E-04	7.70E-05
	4	1.60E-02	6.40E-04	7.90E-04	7.10E-03	2.70E-06	0.00E+00	7.90E-07	1.90E-05	6.80E-05
EI-VI-SPR	1	5.10E-03	2.10E-07	1.20E-07	7.50E-08	1.20E-10	0.00E+00	3.70E-12	3.20E-11	3.20E-09
(STC-12)	2	2.50E-02	2.40E-06	7.50E-07	9.80E-07	7.10E-09	0.00E+00	2.50E-10	1.80E-09	7.20E-08
	3	3.80E-02	8.20E-07	1.50E-07	3.50E-07	7.90E-08	0.00E+00	3.20E-09	2.50E-08	1.00E-07
EI-VI-UNM	1	6.40E-01	2.40E-04	1.00E-04	8.30E-05	8.60E-07	1.20E-06	3.80E-08	2.40E-07	1.60E-05
(STC-13)	2	2.00E-01	2.00E-04	3.80E-05	7.10E-05	4.50E-06	0.00E+00	8.80E-08	5.40E-07	2.90E-05
	3	1.00E-01	2.00E-05	4.50E-06	1.40E-05	1.80E-05	0.00E+00	2.70E-06	5.40E-06	8.80E-05
	4	2.50E-02	1.10E-06	2.00E-07	4.00E-07	1.80E-08	0.00E+00	3.00E-09	5.90E-09	1.30E-07

STC Designator	Plume No.	Release Fraction (MACCS2 Group)								
		Kr/Xe	I	Cs	Te/Sb	Sr	Ru	La	Ce	Ba
EP-VF-SPR	1	8.00E-01	6.10E-04	2.10E-04	1.10E-04	9.70E-06	3.20E-07	4.90E-07	2.70E-06	7.00E-05
(STC-14)	2	1.90E-01	1.20E-03	2.10E-04	2.10E-05	2.10E-05	0.00E+00	2.40E-06	2.40E-05	1.10E-05
	3	2.10E-03	5.20E-05	1.20E-05	2.10E-06	3.10E-07	0.00E+00	2.80E-08	3.40E-07	1.30E-07
	4	3.40E-03	4.00E-05	5.40E-05	6.60E-05	3.90E-07	0.00E+00	8.20E-08	1.80E-06	4.80E-06
EP-VF-SUP	1	9.90E-01	3.00E-03	6.30E-04	1.80E-04	6.00E-05	4.50E-07	5.30E-06	5.30E-05	1.10E-04
(STC-15)	2	1.20E-02	7.70E-04	2.40E-04	2.10E-05	3.80E-06	0.00E+00	2.80E-07	4.10E-06	1.50E-06
	3	0.00E+00	1.30E-04	1.20E-04	3.10E-04	1.90E-05	0.00E+00	8.60E-07	2.10E-05	2.30E-05
EP-VF-UNH	1	1.00E+00	2.30E-01	4.90E-02	2.30E-02	1.60E-03	4.70E-04	7.70E-04	3.50E-03	1.30E-03
(STC-16)	2	1.90E-03	3.70E-03	5.00E-03	1.30E-02	1.20E-08	0.00E+00	5.20E-09	2.80E-08	1.00E-08
	3	2.40E-06	1.90E-02	3.70E-03	6.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-07
EP-VF-UNM	1	9.90E-01	3.20E-02	5.30E-03	7.00E-04	7.60E-04	8.10E-07	8.40E-05	7.80E-04	3.70E-04
(STC-17)	2	8.00E-03	3.00E-03	1.50E-03	1.70E-04	1.90E-05	0.00E+00	1.30E-06	2.00E-05	7.20E-06
	3	2.00E-08	7.80E-04	3.80E-04	3.50E-03	9.50E-05	0.00E+00	3.40E-06	8.60E-05	1.00E-04
EP-VI-SPR	1	5.50E-01	3.70E-04	1.20E-04	1.40E-04	3.20E-06	1.60E-07	8.90E-08	5.70E-07	4.10E-05
(STC-18)	2	3.50E-01	4.20E-04	5.40E-05	1.30E-04	2.60E-06	0.00E+00	2.50E-08	2.70E-07	2.00E-05
	3	2.30E-03	1.20E-06	1.40E-07	3.40E-07	2.90E-09	0.00E+00	1.60E-11	1.70E-10	1.40E-08

STC Designator	Plume No.	Release Fraction (MACCS2 Group)								
		Kr/Xe	I	Cs	Te/Sb	Sr	Ru	La	Ce	Ba
LA-VF-UNH	1	7.80E-01	4.80E-01	2.60E-01	1.50E-01	1.40E-02	3.10E-04	7.10E-04	3.50E-03	9.30E-02
(STC-19)	2	1.50E-01	1.20E-05	2.10E-05	2.20E-05	2.60E-08	0.00E+00	7.10E-09	1.10E-07	8.50E-07
	3	6.40E-02	3.90E-05	3.10E-04	2.40E-04	6.00E-09	0.00E+00	4.60E-10	4.30E-09	1.30E-06
	4	3.80E-03	2.20E-05	4.50E-05	6.80E-05	1.00E-09	0.00E+00	4.00E-11	0.00E+00	2.50E-07
LA-VF-UNM	1	7.80E-01	4.80E-01	2.60E-01	1.50E-01	1.40E-02	3.10E-04	7.10E-04	3.50E-03	9.30E-02
(STC-20)	2	1.50E-01	1.20E-05	2.10E-05	2.20E-05	2.60E-08	0.00E+00	7.10E-09	1.10E-07	8.50E-07
	3	6.40E-02	3.90E-05	3.10E-04	2.40E-04	6.00E-09	0.00E+00	4.60E-10	4.30E-09	1.30E-06
	4	3.80E-03	2.20E-05	4.50E-05	6.80E-05	1.00E-09	0.00E+00	4.00E-11	0.00E+00	2.50E-07
LP-VF-SPR	1	7.90E-01	5.80E-04	2.00E-04	1.10E-04	1.10E-05	3.00E-07	6.50E-07	3.90E-06	7.00E-05
(STC-21)	2	2.00E-01	1.50E-03	2.40E-04	2.30E-05	1.60E-05	0.00E+00	1.40E-06	1.50E-05	9.20E-06
	3	1.10E-03	5.50E-06	1.70E-06	1.40E-06	3.60E-07	0.00E+00	6.70E-09	2.10E-07	1.60E-07
	4	4.10E-03	1.70E-05	1.60E-05	7.50E-05	2.40E-06	0.00E+00	2.00E-07	4.20E-06	6.20E-06
LP-VF-SUP	1	9.90E-01	9.80E-04	2.50E-04	1.70E-04	2.20E-05	7.20E-06	1.10E-05	4.30E-05	4.30E-05
(STC-22)	2	9.50E-03	1.80E-03	1.20E-03	9.40E-04	1.50E-09	0.00E+00	6.90E-10	3.10E-09	4.10E-09
	3	1.60E-03	4.00E-04	1.00E-03	2.10E-03	1.20E-10	0.00E+00	4.90E-11	2.30E-10	6.40E-10
	4	4.30E-06	2.60E-03	6.40E-04	1.20E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-08

STC Designator	Plume No.	Release Fraction (MACCS2 Group)								
		Kr/Xe	I	Cs	Te/Sb	Sr	Ru	La	Ce	Ba
LP-VF-UNH	1	9.00E-01	3.80E-02	5.50E-03	2.80E-03	1.60E-03	4.60E-04	7.60E-04	3.50E-03	1.30E-03
(STC-23)	2	9.30E-02	1.90E-01	3.90E-02	1.50E-02	4.90E-06	0.00E+00	2.10E-06	1.10E-05	3.90E-06
	3	4.40E-03	1.30E-02	9.40E-03	1.80E-02	4.00E-08	0.00E+00	1.70E-08	9.20E-08	3.30E-08
	4	2.60E-06	1.90E-02	3.80E-03	6.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-07
LP-VF-UNM	1	9.80E-01	1.50E-02	2.80E-03	9.00E-04	1.40E-03	1.90E-06	1.50E-04	1.50E-03	6.60E-04
(STC-24)	2	2.10E-02	6.30E-03	1.20E-03	1.80E-03	7.80E-04	0.00E+00	2.70E-05	6.50E-04	3.00E-04
	3	2.50E-04	1.40E-03	1.40E-03	1.30E-03	3.10E-04	0.00E+00	2.20E-05	5.50E-04	2.10E-04
	4	1.10E-04	5.30E-03	3.00E-03	6.90E-03	1.20E-07	0.00E+00	4.30E-09	1.40E-08	2.90E-05
LV-VF-SPR	1	9.00E-01	5.10E-04	1.40E-04	1.60E-04	2.10E-05	1.40E-06	5.60E-06	4.00E-05	5.20E-05
(STC-25)	2	9.20E-02	3.20E-04	5.70E-05	1.30E-04	2.30E-06	0.00E+00	6.50E-07	4.80E-06	1.60E-06
	3	7.40E-03	1.50E-04	3.80E-05	6.90E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-09
	4	8.80E-05	1.20E-06	1.40E-06	2.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.80E-10
LV-VF-SUP	1	1.00E+00	8.40E-04	3.70E-04	3.00E-04	1.40E-05	3.70E-06	6.10E-06	2.50E-05	6.40E-05
(STC-26)	2	1.30E-03	1.00E-04	2.80E-04	2.80E-04	4.50E-10	0.00E+00	2.20E-10	9.40E-10	6.00E-10
	3	1.20E-06	2.20E-03	4.10E-04	1.20E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E-09
	4	2.00E-06	6.90E-03	1.60E-03	1.70E-03	1.00E-12	0.00E+00	0.00E+00	0.00E+00	5.90E-08

STC Designator	Plume No.	Release Fraction (MACCS2 Group)								
		Kr/Xe	I	Cs	Te/Sb	Sr	Ru	La	Ce	Ba
LV-VF-UNH	1	8.00E-01	6.50E-03	1.20E-03	1.70E-03	2.10E-03	5.20E-04	9.20E-04	4.60E-03	1.30E-03
(STC-27)	2	2.00E-01	2.60E-01	4.80E-02	1.90E-02	3.80E-04	0.00E+00	1.70E-04	8.30E-04	2.40E-04
	3	1.30E-03	1.80E-02	1.20E-02	2.50E-02	9.70E-08	0.00E+00	4.20E-08	2.10E-07	6.90E-08
	4	2.40E-06	1.80E-02	3.50E-03	6.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.90E-07
LV-VF-UNM	1	9.80E-01	4.00E-03	9.90E-04	4.80E-04	1.10E-04	2.20E-06	1.30E-05	1.00E-04	2.50E-04
(STC-28)	2	2.20E-02	2.50E-03	6.30E-04	2.60E-04	3.90E-04	0.00E+00	4.60E-05	4.60E-04	1.40E-04
	3	1.20E-04	6.70E-04	6.90E-04	6.40E-03	7.40E-05	0.00E+00	3.70E-06	8.50E-05	1.00E-04
	4	0.00E+00	2.80E-04	5.50E-04	4.00E-03	5.60E-08	0.00E+00	2.00E-09	7.60E-09	1.10E-05
TA-VF-UNM	1	9.80E-01	2.90E-02	2.60E-02	1.30E-02	5.00E-03	5.80E-05	3.10E-04	7.10E-04	1.90E-02
(STC-29)[1]	2	4.00E-03	6.60E-04	3.00E-04	3.90E-03	2.40E-06	0.00E+00	3.70E-07	9.10E-06	8.10E-06
	3	1.20E-02	2.90E-02	1.50E-02	1.10E-02	1.00E-06	0.00E+00	1.30E-07	2.50E-06	1.60E-04
	4	2.10E-03	1.40E-02	8.40E-03	1.30E-03	4.80E-08	0.00E+00	3.30E-09	2.00E-08	3.10E-05
TP-VF-SPR	1	5.70E-01	5.10E-04	5.80E-04	3.30E-04	1.70E-06	9.70E-09	2.20E-08	2.10E-07	2.90E-06
(STC-30)[1]	2	2.80E-01	3.20E-04	2.50E-04	2.90E-04	3.70E-05	2.20E-06	1.60E-06	4.20E-06	2.40E-04
	3	8.20E-02	2.30E-04	5.80E-05	1.10E-04	4.20E-05	0.00E+00	2.40E-06	6.60E-06	1.70E-04
	4	6.00E-02	8.20E-04	1.70E-04	6.80E-05	1.80E-05	9.70E-09	2.20E-06	2.40E-05	7.20E-06

STC Designator	Plume No.	Release Fraction (MACCS2 Group)								
		Kr/Xe	I	Cs	Te/Sb	Sr	Ru	La	Ce	Ba
TP-VF-SUP (STC-31)[1]	1	5.70E-01	5.10E-04	5.80E-04	3.30E-04	1.70E-06	9.70E-09	2.20E-08	2.10E-07	2.90E-06
	2	2.80E-01	3.20E-04	2.50E-04	2.90E-04	3.70E-05	2.20E-06	1.60E-06	4.20E-06	2.40E-04
	3	8.20E-02	2.30E-04	5.80E-05	1.10E-04	4.20E-05	0.00E+00	2.40E-06	6.60E-06	1.70E-04
	4	6.00E-02	8.20E-04	1.70E-04	6.80E-05	1.80E-05	9.70E-09	2.20E-06	2.40E-05	7.20E-06
TP-VF-UNM (STC-32)[1]	1	4.80E-02	3.50E-04	2.30E-04	5.90E-06	1.10E-07	0.00E+00	6.50E-10	4.70E-09	4.60E-07
	2	6.60E-01	1.30E-03	3.20E-04	1.20E-03	1.20E-04	6.10E-06	5.50E-06	3.00E-05	8.90E-04
	3	8.20E-02	7.40E-03	1.40E-03	7.70E-04	3.50E-03	7.80E-07	3.80E-04	3.70E-03	1.30E-03

Note:

1. ATWS STC scenarios (STC-29, -30, -31, and -32) from plant damage state (PDS) 4 are mapped to surrogate STCs from PDS 2 (STC-3, -5, -5, and -6 respectively). Input/Results for the surrogate STC are assumed representative of the ATWS STC in this analysis

Table G1.4-6 Perry Level 2 Source Term Category Summary

STC Number	STC Designator	Description
STC-1	AP	Alpha Mode failure of containment. An in-vessel steam explosion fails both the reactor pressure vessel (RPV) and the containment building.
STC-2	BP	Bypass of containment. Associated with an Interfacing Systems LOCA (ISLOCA) and Plant Damage State (PDS) 5.
STC-3	CA-VF-UNM	Anchorage failure before core damage, the RPV fails, and the release is unmitigated. Associated with a successful shutdown the reactor with no containment heat removal and a containment over pressurization (PDS 2). The containment experiences a gross failure at the anchor bolts, causing a failure of the injection piping to the RPV, leading to core damage and vessel failure. The containment failure also generates a bypass of the suppression pool, leading to an unmitigated release.
STC-4	CI (Leak)	The containment is intact, restricting source term fission products to be released to the environment from normal containment leakage.
STC-5	CP-VF-SUP	Penetration/Dome failure before core damage, the RPV fails. The release is mitigated by the suppression pool. Associated with a successful shutdown of the reactor with no containment heat removal and containment over pressurization (PDS 2). The containment experiences a gross failure at either a penetration or at the containment dome, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The suppression pool mitigates the release.

STC Number	STC Designator	Description
STC-6	CP-VF-UNM	Penetration/Dome failure before core damage, the RPV fails, and the release is unmitigated. Associated with a successful shutdown of the reactor with no containment heat removal and containment over pressurization (PDS 2). The containment experiences a gross failure at either a penetration or at the containment dome, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The containment failure also generates a bypass of the suppression pool, leading to an unmitigated release.
STC-7	EA-VF-UNH	Anchorage failure before core damage, the RPV fails while at high pressure (depressurization failed throughout the transient), and the release is unmitigated. The containment experiences a gross failure at the anchor bolts, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The containment failure also fails the containment sprays and generates a bypass of the suppression pool, leading to an unmitigated release.
STC-8	EA-VF-UNM	Anchorage failure before core damage, the RPV fails, and the release is unmitigated. The containment experiences a gross failure at the anchor bolts, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The containment failure also fails the containment sprays and generates a bypass of the suppression pool, leading to an unmitigated release.
STC-9	EI-VF-SPR	Failure of containment isolation leads to a release pathway to the environment. The RPV fails and the release is mitigated by the containment sprays.
STC-10	EI-VF-UNH	Failure of containment isolation leads to a release pathway to the environment. The RPV fails while at high pressure (depressurization failed throughout the transient) and the release is unmitigated.

STC Number	STC Designator	Description
STC-11	EI-VF-UNM	Failure of containment isolation leads to a release pathway to the environment. The RPV fails and the release is unmitigated.
STC-12	EI-VI-SPR	Failure of containment isolation leads to a release pathway to the environment. The RPV is reflooded after the core has been damaged and any fission product release is mitigated by the containment sprays.
STC-13	EI-VI-UNM	Failure of containment isolation leads to a release pathway to the environment. The RPV is reflooded after the core has been damaged and any fission product release is unmitigated.
STC-14	EP-VF-SPR	Penetration/Dome failure before core damage, the RPV fails, and the release is mitigated by the containment sprays. The containment experiences a gross failure at either a penetration or at the containment dome prior to core damage and RPV failure.
STC-15	EP-VF-SUP	Penetration/Dome failure before core damage, the RPV fails, and the release is mitigated by the suppression pool. The containment experiences a gross failure at either a penetration or at the containment dome prior to core damage and RPV failure.
STC-16	EP-VF-UNH	Penetration/Dome failure before core damage, the RPV fails while at high pressure (depressurization failed throughout the transient), and the release is unmitigated. The containment experiences a gross failure at either a penetration or at the containment dome prior to core damage and RPV failure.
STC-17	EP-VF-UNM	Penetration/Dome failure before core damage, the RPV fails, and the release is unmitigated. The containment experiences a gross failure at either a penetration or at the containment dome prior to core damage and RPV failure.

STC Number	STC Designator	Description
STC-18	EP-VI-SPR	Penetration/Dome failure before core damage, the RPV is reflooded prior to RPV failure, and the release is mitigated by the containment sprays. The containment experiences a gross failure at either a penetration or at the containment dome prior to core damage and RPV reflooding.
STC-19	LA-VF-UNH	Anchorage failure after core damage, the RPV fails while at high pressure (depressurization failed throughout the transient), and the release is unmitigated. The containment experiences a gross failure at the anchor bolts, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The containment failure also fails the containment sprays and generates a bypass of the suppression pool, leading to an unmitigated release.
STC-20	LA-VF-UNM	Anchorage failure after core damage, the RPV fails, and the release is unmitigated. The containment experiences a gross failure at the anchor bolts, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The containment failure also fails the containment sprays and generates a bypass of the suppression pool, leading to an unmitigated release.
STC-21	LP-VF-SPR	Penetration/Dome failure after core damage, the RPV fails, and the release is mitigated by the containment sprays. The containment experiences a gross failure at either a penetration or at the containment dome after core damage and RPV failure.
STC-22	LP-VF-SUP	Penetration/Dome failure after core damage, the RPV fails, and the release is mitigated by the suppression pool. The containment experiences a gross failure at either a penetration or at the containment dome after core damage and RPV failure.

STC Number	STC Designator	Description
STC-23	LP-VF-UNH	Penetration/Dome failure after core damage, the RPV fails while at high pressure (depressurization failed throughout the transient), and the release is unmitigated. The containment experiences a gross failure at either a penetration or at the containment dome after core damage and RPV failure.
STC-24	LP-VF-UNM	Penetration/Dome failure after core damage, the RPV fails, and the release is unmitigated. The containment experiences a gross failure at either a penetration or at the containment dome after core damage and RPV failure.
STC-25	LV-VF-SPR	The containment function is considered failed as the containment is being vented. The RPV fails and the release is mitigated by the containment sprays.
STC-26	LV-VF-SUP	The containment function is considered failed as the containment is being vented. The RPV fails and the release is mitigated by the suppression pool.
STC-27	LV-VF-UNH	The containment function is considered failed as the containment is being vented. The RPV fails while at high pressure (depressurization failed throughout the transient) and the release is unmitigated.
STC-28	LV-VF-UNM	The containment function is considered failed as the containment is being vented. The RPV fails and the release is unmitigated.
STC-29	TA-VF-UNM	Anchorage failure before core damage, the RPV fails, and the release is unmitigated. Associated with a critical ATWS (PDS 4). The containment experiences a gross failure at the anchor bolts, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The containment failure also generates a bypass of the suppression pool, leading to an unmitigated release.

STC Number	STC Designator	Description
STC-30	TP-VF-SPR	Penetration/Dome failure before core damage, the RPV fails, and the release is mitigated by the containment sprays. Associated with a critical ATWS (PDS 4). The containment experiences a gross failure at either a penetration or at the containment dome around the time of core damage and RPV failure. The containment sprays mitigate the release.
STC-31	TP-VF-SUP	Penetration/Dome failure before core damage, the RPV fails, and the release is mitigated by the suppression pool. Associated with a critical ATWS (PDS 4). The containment experiences a gross failure at either a penetration or at the containment dome, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The suppression pool mitigates the release.
STC-32	TP-VF-UNM	Penetration/Dome failure before core damage, the RPV fails, and the release is unmitigated. Associated with a critical ATWS (PDS 4). The containment experiences a gross failure at either a penetration or at the containment dome, causing a failure of the injection piping to the RPV, leading to core damage and RPV failure. The containment failure also generates a bypass of the suppression pool, leading to an unmitigated release.

The PNPP STC timing parameters for WinMACCS, site alarm is initiation (OALARM), representative time point for dispersion and radioactive decay (REFTIM), maximum plume duration (PLUDUR) and start time of each plume segment from accident initiation (PDELAY), were taken from specific MAAP analyses that was performed in support of the Level 3 analysis. The heat content of the release segment, parameter (PLHEAT) was conservatively set to zero watts (0.00E+00 watts) for this Level 3 analysis. Three sensitivity analyses were also performed to determine the impact of different PLHEAT values on total dose, the total dollar cost incurred to the decontamination of farmland and non-farmland including the cost of relocating a population that lives within this boundary, and the potential health effects to the population around the PNPP site (50-mile radius).

Other terms associated with the release times are shown below (Table G1.4-7). They are assigned to each source term according to the STC number. Each release plume (NUMREL) has multiple segments and a risk-dominant plume segment (MAXRIS). The early rupture and the bypass releases are essentially puff releases and the early leak and late failures are more continuous. The timing data is shown below. For plume release height, a mid-containment release height of 22.4 meters (73.5 feet) was used for all STCs, consistent with the guidance of NEI 05-01 (NEI 2005). Two sensitivity analyses were also performed to determine the impact of different height of each plume segment at release (PLHITE) values on total dose, total dollar cost, and the potential health effects to the population around the PNPP site (50-mile radius).

Table G1.4-7 Source Term Category Timing Parameters and Values

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
AP (STC-1)	1	74318	3	1	0.0	0.0E+00	22.4	13822	87259
	2	74318			0.0	0.0E+00	22.4	17400	132285
	3	74318			0.0	0.0E+00	22.4	109515[1] (86400)	149685
BP (STC-2)	1	7	4	1	0.0	0.0E+00	22.4	16853	0
	2	7			0.5	0.0E+00	22.4	1804	16853
	3	7			0.5	0.0E+00	22.4	99398[1] (86400)	18656
	4	7			0.5	0.0E+00	22.4	141147[1] (86400)	118055
CA-VF-UNM (STC-3)	1	72299	4	1	0.0	0.0E+00	22.4	209604[1] (86400)	77911
	2	72299			0.0	0.0E+00	22.4	57302	287515
	3	72299			0.5	0.0E+00	22.4	753253[1] (86400)	344816

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
	4	72299			0.5	0.0E+00	22.4	1493931[1] (86400)	1098070
CI (Leak) (STC-4)	1	62082	4	2	0.0	0.0E+00	22.4	20820	64655
	2	62082			0.0	0.0E+00	22.4	13837	85475
	3	62082			0.0	0.0E+00	22.4	33988	99311
	4	62082			0.0	0.0E+00	22.4	125901[1] (86400)	133300
CP-VF-SUP (STC-5)	1	73652	4	1	0.0	0.0E+00	22.4	5409	79142
	2	73652			0.0	0.0E+00	22.4	9628	84550
	3	73652			0.0	0.0E+00	22.4	17444	94178
	4	73652			0.0	0.0E+00	22.4	147580[1] (86400)	111623
CP-VF-UNM (STC-6)	1	77724	4	2	0.0	0.0E+00	22.4	7547	81787
	2	77724			0.0	0.0E+00	22.4	15051	89334
	3	77724			0.5	0.0E+00	22.4	27039	104385

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
	4	77724			0.5	0.0E+00	22.4	37772	221428
EA-VF-UNH (STC-7)	1	1429	4	2	0.0	0.0E+00	22.4	5117	6938
	2	1429			0.0	0.0E+00	22.4	12025	12056
	3	1429			0.5	0.0E+00	22.4	69900	24081
	4	1429			0.5	0.0E+00	22.4	165223[1] (86400)	93981
EA-VF-UNM (STC-8)	1	1289	4	2	0.0	0.0E+00	22.4	9922	4811
	2	1289			0.0	0.0E+00	22.4	6931	14733
	3	1289			0.0	0.0E+00	22.4	76974	21664
	4	1289			0.5	0.0E+00	22.4	160564[1] (86400)	98638
EI-VF-SPR (STC-9)	1	1354	4	2	0.0	0.0E+00	22.4	7522	6619
	2	1354			0.0	0.0E+00	22.4	38159	14141
	3	1354			0.5	0.0E+00	22.4	81811	52300

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
	4	1354			0.5	0.0E+00	22.4	125090[1] (86400)	134111
EI-VF-UNH (STC-10)	1	1429	4	2	0.0	0.0E+00	22.4	5121	6333
	2	1429			0.0	0.0E+00	22.4	3910	11454
	3	1429			0.5	0.0E+00	22.4	76221	15364
	4	1429			0.5	0.0E+00	22.4	167618[1] (86400)	91585
EI-VF-UNM (STC-11)	1	62752	4	1	0.0	0.0E+00	22.4	6910	63707
	2	62752			0.0	0.0E+00	22.4	23156	70617
	3	62752			0.0	0.0E+00	22.4	47708	93773
	4	62752			0.0	0.0E+00	22.4	117720[1] (86400)	141481

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
EI-VI-SPR (STC-12)	1	63191	3	2	0.5	0.0E+00	22.4	8727	67082
	2	63191			0.0	0.0E+00	22.4	28316	75808
	3	63191			0.5	0.0E+00	22.4	155078[1] (86400)	104124
EI-VI-UNM (STC-13)	1	63205	4	1	0.0	0.0E+00	22.4	10531	66792
	2	63205			0.0	0.0E+00	22.4	15078	77323
	3	63205			0.5	0.0E+00	22.4	87484[1] (86400)	92401
	4	63205			0.5	0.0E+00	22.4	79315	179885
EP-VF-SPR (STC-14)	1	61675	4	1	0.0	0.0E+00	22.4	3309	88672
	2	61675			0.5	0.0E+00	22.4	8400	91981
	3	61675			0.0	0.0E+00	22.4	75613	100381
	4	61675			0.5	0.0E+00	22.4	83206	175994
EP-VF-SUP (STC-15)	1	62622	3	1	0.0	0.0E+00	22.4	9619	89898
	2	62622			0.0	0.0E+00	22.4	67203	99517

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
	3	62622			0.0	0.0E+00	22.4	92484[1] (86400)	166720
EP-VF-UNH (STC-16)	1	63162	3	1	0.0	0.0E+00	22.4	16205	83293
	2	63162			0.5	0.0E+00	22.4	70500	99498
	3	63162			0.0	0.0E+00	22.4	89205[1] (86400)	169998
EP-VF-UNM (STC-17)	1	62622	3	1	0.0	0.0E+00	22.4	10817	89898
	2	62622			0.5	0.0E+00	22.4	59406	100716
	3	62622			0.0	0.0E+00	22.4	99080[1] (86400)	160122
EP-VI-SPR (STC-18)	1	62921	3	1	0.0	0.0E+00	22.4	1803	76378
	2	62921			0.5	0.0E+00	22.4	5727	78181
	3	62921			0.5	0.0E+00	22.4	175294[1] (86400)	83908
LA-VF-UNH	1	63162	4	1	0.0	0.0E+00	22.4	4510	69947

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
(STC-19)	2	63162			0.0	0.0E+00	22.4	28521	74457
	3	63162			0.0	0.0E+00	22.4	98909[1] (86400)	102978
	4	63162			0.5	0.0E+00	22.4	57315	201886
LA-VF-UNM (STC-20)	1	1523	4	1	0.0	0.0E+00	22.4	4510	69947
	2	1523			0.0	0.0E+00	22.4	28521	74457
	3	1523			0.0	0.0E+00	22.4	98909[1] (86400)	102978
	4	1523			0.5	0.0E+00	22.4	57315	201886
LP-VF-SPR (STC-21)	1	61589	4	1	0.0	0.0E+00	22.4	3003	89631
	2	61589			0.0	0.0E+00	22.4	8708	92635
	3	61589			0.5	0.0E+00	22.4	78002	101342
	4	61589			0.0	0.0E+00	22.4	79860	179344

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
LP-VF-SUP (STC-22)	1	62140	4	1	0.0	0.0E+00	22.4	9606	81832
	2	62140			0.5	0.0E+00	22.4	6000	91438
	3	62140			0.5	0.0E+00	22.4	71400	97438
	4	62140			0.0	0.0E+00	22.4	90365[1] (86400)	168838
LP-VF-UNH (STC-23)	1	63162	4	1	0.0	0.0E+00	22.4	4505	83293
	2	63162			0.0	0.0E+00	22.4	8400	87797
	3	63162			0.0	0.0E+00	22.4	74700	96197
	4	63162			0.0	0.0E+00	22.4	88305[1] (86400)	170897
LP-VF-UNM (STC-24)	1	47765	4	1	0.0	0.0E+00	22.4	7811	73269
	2	47765			0.0	0.0E+00	22.4	9302	81081
	3	47765			0.0	0.0E+00	22.4	89725[1] (86400)	90383
	4	47765			0.0	0.0E+00	22.4	79093	180108

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
LV-VF-SPR (STC-25)	1	62492	4	1	0.0	0.0E+00	22.4	13827	75748
	2	62492			0.5	0.0E+00	22.4	172805[1] (86400)	89575
	3	62492			0.0	0.0E+00	22.4	728400[1] (86400)	262380
	4	62492			0.5	0.0E+00	22.4	1601225[1] (86400)	990780
LV-VF-SUP (STC-26)	1	62863	4	1	0.0	0.0E+00	22.4	31831	76106
	2	62863			0.5	0.0E+00	22.4	61500	107936
	3	62863			0.0	0.0E+00	22.4	46500	169436
	4	62863			0.5	0.0E+00	22.4	144065[1] (86400)	215936
LV-VF-UNH (STC-27)	1	63162	4	1	0.0	0.0E+00	22.4	8126	76368
	2	63162			0.0	0.0E+00	22.4	9900	84495
	3	63162			0.0	0.0E+00	22.4	58200	94395

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
	4	63162			0.0	0.0E+00	22.4	106610[1] (86400)	152595
LV-VF-UNM (STC-28)	1	57686	4	1	0.0	0.0E+00	22.4	23761	73080
	2	57686			0.0	0.0E+00	22.4	24004	96841
	3	57686			0.0	0.0E+00	22.4	109823[1] (86400)	120845
	4	57686			0.5	0.0E+00	22.4	28534	230668
TA-VF-UNM (STC-29)[4]	1	72299	4	1	0.0	0.0E+00	22.4	209604[1] (86400)	77911
	2	72299			0.0	0.0E+00	22.4	57302	287515
	3	72299			0.5	0.0E+00	22.4	753253[1] (86400)	344816
	4	72299			0.5	0.0E+00	22.4	1493931[1] (86400)	1098070

STC	Plume No.	OALARM (s)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (W)[2]	PLHITE (m)	PLUDUR (s)	PDELAY (s)[3]
TP-VF-SPR (STC-30)[4]	1	73652	4	1	0.0	0.0E+00	22.4	5409	79142
	2	73652			0.0	0.0E+00	22.4	9628	84550
	3	73652			0.0	0.0E+00	22.4	17444	94178
	4	73652			0.0	0.0E+00	22.4	147580[1] (86400)	111623
TP-VF-SUP (STC-31)[4]	1	73652	4	1	0.0	0.0E+00	22.4	5409	79142
	2	73652			0.0	0.0E+00	22.4	9628	84550
	3	73652			0.0	0.0E+00	22.4	17444	94178
	4	73652			0.0	0.0E+00	22.4	147580[1] (86400)	111623
TP-VF-UNM (STC-32)[4]	1	77724	4	2	0.0	0.0E+00	22.4	7547	81787
	2	77724			0.0	0.0E+00	22.4	15051	89334
	3	77724			0.5	0.0E+00	22.4	27039	104385
	4	77724			0.5	0.0E+00	22.4	37772	221428

Notes:

1. The maximum plume duration (PLUDUR) is 1 day (86,400 sec), (SAND 1998; SAND 2021).

2. Plume heat release rate (PLHEAT) is conservatively assumed 0.00E+00 watts. Cases 6, 7, and 8 sensitivities evaluate additional plume heat values, 1E+06 watts, 1E+10 watts, and 1E+03 watts, respectively.

3. The maximum start time of each plume segment in seconds from the time of accident initiation (PDELAY) is 30 days (2,592,000 sec) (SAND 2021).

4. ATWS STC scenarios (STC-29, -30, -31, and -32) from plant damage state (PDS) 4 are mapped to surrogate STCs from PDS 2 (STC-3, -5, -5, and -6 respectively)

PDS 4 contains sequences with core damage arising following ATWS with failure to control reactivity. These accident sequences are anticipated to occur at high pressure with a high level of heat generation from the reactor core, and hence a high heat load into the containment. These conditions are expected to cause containment pressurization and consequent failure on timescales similar to those for core damage. The sequences in this PDS are therefore similar to those in PDS 2 except that the sprays may be available for fission product release mitigation. It was also considered convenient from a presentational point of view to create a separate PDS for these sequences arising from ATWS, rather than including these sequences into a single PDS 2.

Qualitative means were used for assessing PDS 4, as MAAP calculations are not available for this PDS, since MAAP has inadequacies with simulating these ATWS scenarios.

Input/Results for the surrogate STC are assumed representative of the ATWS STC in this analysis.

The base case population dose risk and economic risk results from the Level 3 analysis are shown in Table G1.4-8 by STC.

Table G1.4-8 PNPP Base Case Population Dose Risk and Economic Risk

CET End Point (Release Mode)	Population Dose (Sieverts)	Offsite Economic Cost ($)	CET End Point (Release Mode)	Population Dose (Sieverts)	Offsite Economic Cost ($)
AP (STC-1)	5.64E+04	2.95E+10	EP-VF-UNM (STC-17)	1.90E+04	6.23E+09
BP (STC-2)	1.71E+05	9.70E+10	EP-VI-SPR (STC-18)	1.15E+03	6.20E+07
CA-VF-UNM (STC-3)	5.17E+04	2.46E+10	LA-VF-UNH (STC-19)	4.70E+04	3.55E+10
CI (Leak) (STC-4)	1.86E+04	6.18E+09	LA-VF-UNM (STC-20)	4.29E+04	3.55E+10
CP-VF-SUP (STC-5)	6.38E+03	3.68E+08	LP-VF-SPR (STC-21)	2.90E+03	1.38E+08
CP-VF-UNM (STC-6)	2.74E+04	1.04E+10	LP-VF-SUP (STC-22)	1.41E+04	1.98E+09
EA-VF-UNH (STC-7)	9.70E+04	3.52E+10	LP-VF-UNH (STC-23)	4.94E+04	2.16E+10
EA-VF-UNM (STC-8)	2.29E+04	1.01E+10	LP-VF-UNM (STC-24)	2.77E+04	1.02E+10
EI-VF-SPR (STC-9)	5.63E+03	2.70E+08	LV-VF-SPR (STC-25)	2.02E+03	1.17E+08
EI-VF-UNH (STC-10)	5.41E+04	1.83E+10	LV-VF-SUP (STC-26)	1.38E+04	1.57E+09
EI-VF-UNM (STC-11)	1.93E+04	4.02E+09	LV-VF-UNH (STC-27)	5.72E+04	2.46E+10
EI-VI-SPR (STC-12)	9.25E+00	4.12E+06	LV-VF-UNM (STC-28)	1.68E+04	3.53E+09
EI-VI-UNM (STC-13)	1.10E+03	5.88E+07	TA-VF-UNM (STC-29)	5.17E+04	2.46E+10
EP-VF-SPR (STC-14)	3.15E+03	1.62E+08	TP-VF-SPR (STC-30)	6.38E+03	3.68E+08
EP-VF-SUP (STC-15)	6.30E+03	3.33E+08	TP-VF-SUP (STC-31)	6.38E+03	3.68E+08
EP-VF-UNH (STC-16)	5.23E+04	2.28E+10	TP-VF-UNM (STC-32)	2.74E+04	1.04E+10

Population dose risk was estimated by summing the products of population dose (person-rem) and frequency (events/yr) for each accidental release (STC-1 through STC-32). Similarly, offsite economic risk was estimated by summing the products of offsite economic cost (dollars) and frequency (events/yr) for each accidental release (STC-1 through STC-32). Offsite economic cost includes costs that could be incurred during the emergency response phase and costs that could be incurred through long-term protective actions.

The 32 source term categories were grouped into eleven release categories as shown in Table G1.4-9. The frequency of each release category bin results are shown in Tables G1.4-10 and G1.4-11 for the internal events/internal flooding (IEIF) PRA model and seismic PRA model, respectively.

Table G1.4-9 PNPP Release Category Bins

Release Category	Source Term Categories
Break Outside Containment (BOC)	BP (STC-2)
Large, Early (L/E)	AP (STC-1) EA-VF-UNH (STC-7) EI-VF-UNH (STC-10) EP-VF-UNH (STC-16) LA-VF-UNH (STC-19) LP-VF-UNH (STC-23) LV-VF-UNH (STC-27) TA-VF-UNM (STC-29) TP-VF-SUP (STC-31) TP-VF-UNM (STC-32)
Large, Intermediate (L/I)	CA-VF-UNM (STC-3) CP-VF-UNM (STC-6) EA-VF-UNM (STC-8) EP-VF-UNM (STC-17) LA-VF-UNM (STC-20)
Large, Late (L/L)	Not Used
Medium, Early (M/E)	Not Used
Medium, Intermediate (M/I)	EI-VF-UNM (STC-11) LP-VF-UNM (STC-24) LV-VF-SUP (STC-26) LV-VF-UNM (STC-28)
Medium, Late (M/L)	Not Used

Release Category	Source Term Categories
Small, Early (S/E)	CP-VF-SUP (STC-5) EI-VF-SPR (STC-9) EI-VI-UNM (STC-13) EP-VI-SPR (STC-18) TP-VF-SPR (STC-30)
Small, Intermediate (S/I)	EI-VI-SPR (STC-12) EP-VF-SPR (STC-14) EP-VF-SUP (STC-15) LP-VF-SPR (STC-21) LP-VF-SUP (STC-22) LV-VF-SPR (STC-25)
Containment Intact (INTACT)	CI (Leak) (STC-4)

G.1.4.3 Sensitivity Analyses

Twelve (12) total WinMACCS cases were executed for this Level 3 PRA analysis, one base case and eleven (11) additional sensitivity cases. The base case used the best estimate values with year 2046 population projections and 2017-2019 meteorological data (including average mixing height data from 1984-1991) as described in the next section and is termed BASE. The Base Case (Case 1) evacuation modeling was carried out by assuming an evacuation scenario wherein 99.5 percent of the population are evacuated normally, and 0.5 percent are not evacuated at all (within the 10-mile emergency zone). Key economic parameters were updated to 2021-dollar equivalency using consumer price index ratios.

The first sensitivity case (Case 2) on evacuation modeling was carried out by assuming an evacuation scenario wherein 90 percent of the population are evacuated normally, and 10 percent are not evacuated at all (within the 10-mile emergency zone). All other model parameters are identical to the base case.

The second sensitivity case (Case 3) was made using a 50 percent decrease in the timing data for the MACCS parameters time after accident initiating that off-site alarm is initiated (OALARM), duration of plume segment (PLUDUR) and start time of each plume segment from accident initiation (PDELAY). All other model parameters are identical to the base case.

The third sensitivity case (Case 4) was made for the time to take shelter (MACCS parameter DLTSHL) which used 5400 seconds (90 minutes), whereas the base case used 7200 seconds (120 minutes). All other model parameters are identical to the base case.

The fourth and fifth sensitivity cases (Case 5 and Case 6) were made using the minimum and maximum mixing layer heights from the EPA SCRAM data from 1984 through 1991 (EPA 2022). All other model parameters are identical to the base case.

The sixth, seventh, and eighth sensitivity cases (Case 7, 8, and 9) were made on the ATMOS release parameter PLHEAT, using 1E+06, 1E+10, and 1E+03 watts, respectively, as the rate of release of sensible heat in heat in each plume segment, whereas the base case used 0E+00 watts. All other model parameters are identical to the base case.

The ninth sensitivity case (Case 10) was made to determine the impact of decontamination parameters TIMDEC and CDNFRM as to whether and to what extent variations in an uncertain input value might affect the overall cost-benefit conclusions. Parameter TIMDEC represents the time required for completion of each of the decontamination levels. This parameter was changed from the base case value of 1.0368E+07 seconds (120 days) for the dose reduction factor DSRFCT of 15 to 3.15E+07 second (365 days) for the same value of DSRFCT, the maximum parameter value. The TIMDEC parameter for dose reduction factor of 3 remained unchanged at 5.184E+06 seconds (60 days). The non-farmland decontamination cost parameter CDNFRM was changed from the base case value of 19,760 $/person (for the fraction of non-farmland decontamination cost due to labor factor FRNFDL of 0.5) to 1.0E+5 $/person for the same value of FRNFDL, the maximum parameter value and recommended value from NRC Memorandum and Order CLI-16-07 (NRC 2016). The CDNFRM parameter for FRNFDL of 0.7 remained unchanged at 3510 $/person. All other model parameters are identical to the base case.

Tenth and eleventh (Cases 11 and 12) was made to ATMOS release parameter PLHITE, to determine the impact of the height of the release of the plumes using a ground release (0 m) and top of containment release (44.8 m) on the overall cost-benefit conclusions. All other model parameters are identical to the base case.

G.1.4.4 Results

G.1.4.4.1 Base Case Results

Risk estimates for the base case were analyzed with WinMACCS. Tables G1.4-10 and G1.4-11 show the base case mean risk values for each release mode for PNPP IEIF PRA model and seismic PRA model, respectively. The estimated mean values of population dose risk and offsite economic cost risk for PNPP are 17.12 person REM/year and $76,093/yr for the IEIF PRA model and 278 person REM/year and $1,187,391/yr for the seismic PRA model, respectively.

Table G1.4-10 MACCS2 Base Case Release Category Bin Results (Internal Events/Internal Flooding PRA)

RC	Person Rem	Offsite Economic Cost $	Freq (IEIF)	Population Dose Risk (Person Rem/year)	Economic Risk ($/yr)
BOC	1.71E+07	9.70E+10	0.00E+00	0.00E+00	$ -
L/E	4.93E+07	2.23E+11	1.88E-07	9.28E+00	$ 41,960
L/I	1.64E+07	8.68E+10	3.69E-07	6.06E+00	$ 32,070
M/I	5.09E+06	1.41E+10	6.82E-08	3.47E-01	$ 962
M/L	3.31E+06	5.59E+09	0.00E+00	0.00E+00	$ -
S/E	2.06E+06	1.13E+09	6.35E-07	1.31E+00	$ 717
S/I	2.85E+06	2.73E+09	4.52E-09	1.29E-02	$ 12
INTACT	1.86E+06	6.18E+09	6.00E-08	1.12E-01	$ 371
Totals			1.33E-06	17.12	$ 76,093

Table G1.4-11 MACCS2 Base Case Release Category Bin Results (Seismic PRA)

RC	Person Rem	Offsite Economic Cost $	Freq (Seismic)	Population Dose Risk (Person Rem/year)	Economic Risk ($/yr)
BOC	1.71E+07	9.70E+10	0.00E+00	0.00E+00	$ -
L/E	4.93E+07	2.23E+11	5.19E-06	2.56E+02	$ 1,156,679
L/I	1.64E+07	8.68E+10	2.21E-07	3.63E+00	$ 19,195
M/I	5.09E+06	1.41E+10	6.42E-08	3.27E-01	$ 905
M/L	3.31E+06	5.59E+09	0.00E+00	0.00E+00	$ -
S/E	2.06E+06	1.13E+09	9.04E-06	1.86E+01	$ 10,213
S/I	2.85E+06	2.73E+09	4.64E-10	1.32E-03	$ 1
INTACT	1.86E+06	6.18E+09	6.44E-08	1.20E-01	$ 398
Totals			1.46E-05	278.41	$ 1,187,391

G.1.4.4.2 Sensitivity Analysis Case Results

The following results are extracted from the WinMACCS output files produced for 32 STC's for the BASE CASE and sensitivity cases. Reported here are the offsite dose in Sieverts (Tables G1.4-12) and the offsite economic cost in dollars (Table G1.4-13) for each of the 32 CET End Points (release modes). These results are conditional on that release occurring.

Table G1.4-12 Summary of Results - Population Dose (Sieverts) (L-EDEWBODY TOT LIF 0-80.5 km)

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
AP (STC-1)	5.64E+04	5.66E+04	5.23E+04	5.64E+04	5.74E+04	5.57E+04	5.68E+04	5.43E+04	5.64E+04	6.37E+04	5.61E+04	5.79E+04
BP (STC-2)	1.71E+05	1.72E+05	1.82E+05	1.69E+05	1.75E+05	1.67E+05	1.72E+05	1.32E+05	1.71E+05	1.80E+05	1.70E+05	1.75E+05
CA-VF-UNM (STC-3)	5.17E+04	5.18E+04	5.96E+04	5.17E+04	5.28E+04	5.14E+04	5.18E+04	5.19E+04	5.17E+04	5.43E+04	5.18E+04	5.29E+04
CI (Leak) (STC-4)	1.86E+04	1.86E+04	1.68E+04	1.86E+04	1.88E+04	1.83E+04	1.87E+04	1.68E+04	1.86E+04	1.87E+04	1.84E+04	1.88E+04
CP-VF-SUP (STC-5)	6.38E+03	6.39E+03	5.69E+03	6.38E+03	6.41E+03	6.36E+03	6.43E+03	6.30E+03	6.38E+03	6.39E+03	6.29E+03	6.59E+03
CP-VF-UNM (STC-6)	2.74E+04	2.76E+04	2.42E+04	2.74E+04	2.80E+04	2.67E+04	2.74E+04	2.46E+04	2.74E+04	2.72E+04	2.72E+04	2.77E+04
EA-VF-UNH (STC-7)	9.70E+04	9.88E+04	1.15E+05	9.58E+04	9.96E+04	9.47E+04	9.74E+04	7.66E+04	9.70E+04	1.11E+05	9.54E+04	9.96E+04

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
EA-VF-UNM (STC-8)	2.29E+04	2.30E+04	2.24E+04	2.29E+04	2.37E+04	2.24E+04	2.30E+04	2.02E+04	2.29E+04	2.31E+04	2.30E+04	2.35E+04
EI-VF-SPR (STC-9)	5.63E+03	5.63E+03	5.65E+03	5.62E+03	5.66E+03	5.60E+03	5.64E+03	6.04E+03	5.63E+03	5.63E+03	5.55E+03	5.80E+03
EI-VF-UNH (STC-10)	5.41E+04	5.48E+04	6.70E+04	5.27E+04	5.54E+04	5.26E+04	5.40E+04	4.28E+04	5.41E+04	5.77E+04	5.36E+04	5.57E+04
EI-VF-UNM (STC-11)	1.93E+04	1.93E+04	1.63E+04	1.93E+04	1.95E+04	1.92E+04	1.93E+04	1.82E+04	1.93E+04	1.94E+04	1.91E+04	1.96E+04
EI-VI-SPR (STC-12)	9.25E+00	9.28E+00	1.04E+01	9.24E+00	9.36E+00	9.15E+00	9.27E+00	8.95E+00	9.25E+00	9.25E+00	9.16E+00	9.42E+00

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
EI-VI-UNM (STC-13)	1.10E+03	1.10E+03	1.14E+03	1.09E+03	1.10E+03	1.09E+03	1.10E+03	1.13E+03	1.10E+03	1.10E+03	1.08E+03	1.13E+03
EP-VF-SPR (STC-14)	3.15E+03	3.15E+03	3.19E+03	3.15E+03	3.17E+03	3.14E+03	3.19E+03	3.39E+03	3.15E+03	3.15E+03	3.10E+03	3.25E+03
EP-VF-SUP (STC-15)	6.30E+03	6.31E+03	5.81E+03	6.30E+03	6.33E+03	6.27E+03	6.35E+03	5.64E+03	6.30E+03	6.31E+03	6.21E+03	6.47E+03
EP-VF-UNH (STC-16)	5.23E+04	5.26E+04	5.07E+04	5.23E+04	5.35E+04	5.15E+04	5.25E+04	4.60E+04	5.23E+04	5.69E+04	5.18E+04	5.32E+04
EP-VF-UNM (STC-17)	1.90E+04	1.91E+04	1.69E+04	1.90E+04	1.94E+04	1.86E+04	1.91E+04	1.78E+04	1.90E+04	1.92E+04	1.90E+04	1.95E+04

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
EP-VI-SPR (STC-18)	1.15E+03	1.15E+03	1.21E+03	1.15E+03	1.16E+03	1.14E+03	1.16E+03	1.20E+03	1.15E+03	1.15E+03	1.13E+03	1.18E+03
LA-VF-UNH (STC-19)	4.70E+04	4.71E+04	4.83E+04	4.47E+04	4.84E+04	4.56E+04	4.72E+04	3.28E+04	4.70E+04	4.93E+04	4.74E+04	4.73E+04
LA-VF-UNM (STC-20)	4.29E+04	4.34E+04	3.95E+04	4.29E+04	4.42E+04	4.15E+04	4.30E+04	3.26E+04	4.29E+04	4.52E+04	4.32E+04	4.32E+04
LP-VF-SPR (STC-21)	2.90E+03	2.90E+03	2.92E+03	2.90E+03	2.91E+03	2.88E+03	2.91E+03	3.19E+03	2.90E+03	2.90E+03	2.86E+03	2.98E+03
LP-VF-SUP (STC-22)	1.41E+04	1.41E+04	1.32E+04	1.41E+04	1.41E+04	1.40E+04	1.41E+04	1.29E+04	1.41E+04	1.41E+04	1.39E+04	1.45E+04

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
LP-VF-UNH (STC-23)	4.94E+04	4.97E+04	4.47E+04	4.94E+04	5.03E+04	4.88E+04	4.96E+04	4.65E+04	4.94E+04	5.39E+04	4.90E+04	5.03E+04
LP-VF-UNM (STC-24)	2.77E+04	2.78E+04	2.43E+04	2.77E+04	2.82E+04	2.73E+04	2.78E+04	2.57E+04	2.77E+04	2.77E+04	2.74E+04	2.85E+04
LV-VF-SPR (STC-25)	2.02E+03	2.02E+03	2.03E+03	2.02E+03	2.03E+03	2.01E+03	2.03E+03	2.13E+03	2.02E+03	2.02E+03	1.99E+03	2.09E+03
LV-VF-SUP (STC-26)	1.38E+04	1.38E+04	1.29E+04	1.38E+04	1.39E+04	1.36E+04	1.39E+04	1.43E+04	1.38E+04	1.39E+04	1.37E+04	1.39E+04
LV-VF-UNH (STC-27)	5.72E+04	5.76E+04	5.16E+04	5.72E+04	5.77E+04	5.55E+04	5.73E+04	5.27E+04	5.72E+04	6.21E+04	5.66E+04	5.80E+04

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
LV-VF-UNM (STC-28)	1.68E+04	1.68E+04	1.47E+04	1.68E+04	1.71E+04	1.66E+04	1.68E+04	1.55E+04	1.68E+04	1.68E+04	1.68E+04	1.71E+04
TA-VF-UNM (STC-29)[1]	5.17E+04	5.18E+04	5.96E+04	5.17E+04	5.28E+04	5.14E+04	5.18E+04	5.19E+04	5.17E+04	5.43E+04	5.18E+04	5.29E+04
TP-VF-SPR (STC-30)[1]	6.38E+03	6.39E+03	5.69E+03	6.38E+03	6.41E+03	6.36E+03	6.43E+03	6.30E+03	6.38E+03	6.39E+03	6.29E+03	6.59E+03
TP-VF-SUP (STC-31)[1]	6.38E+03	6.39E+03	5.69E+03	6.38E+03	6.41E+03	6.36E+03	6.43E+03	6.30E+03	6.38E+03	6.39E+03	6.29E+03	6.59E+03
TP-VF-UNM (STC-32)[1]	2.74E+04	2.76E+04	2.42E+04	2.74E+04	2.80E+04	2.67E+04	2.74E+04	2.46E+04	2.74E+04	2.72E+04	2.72E+04	2.77E+04

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
Relative Change (%)	-	0.6%	1.6%	-0.7%	2.1%	-1.9%	0.4%	-12.9%	0.0%	5.9%	-0.6%	2.1%

Table G1.4-13 Summary of Results - Offsite Economic Cost ($) (TOTAL ECONOMIC COSTS)

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
AP (STC-1)	2.95E+10	2.95E+10	2.69E+10	2.95E+10	2.97E+10	2.91E+10	2.96E+10	2.86E+10	2.95E+10	5.80E+10	2.92E+10	3.00E+10
BP (STC-2)	9.70E+10	9.70E+10	8.81E+10	9.70E+10	9.85E+10	9.56E+10	9.79E+10	9.33E+10	9.70E+10	1.51E+11	9.61E+10	9.88E+10
CA-VF-UNM (STC-3)	2.46E+10	2.46E+10	2.63E+10	2.46E+10	2.48E+10	2.40E+10	2.46E+10	2.31E+10	2.46E+10	5.33E+10	2.42E+10	2.48E+10
CI (Leak) (STC-4)	6.18E+09	6.18E+09	5.66E+09	6.18E+09	6.20E+09	6.18E+09	6.21E+09	6.02E+09	6.18E+09	9.67E+09	6.10E+09	6.34E+09
CP-VF-SUP (STC-5)	3.68E+08	3.68E+08	5.87E+08	3.68E+08	3.74E+08	3.63E+08	3.68E+08	5.89E+08	3.68E+08	4.55E+08	3.64E+08	3.71E+08
CP-VF-UNM (STC-6)	1.04E+10	1.04E+10	9.48E+09	1.04E+10	1.05E+10	1.04E+10	1.04E+10	1.04E+10	1.04E+10	1.93E+10	1.02E+10	1.08E+10

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
EA-VF-UNH (STC-7)	3.52E+10	3.52E+10	3.12E+10	3.52E+10	3.54E+10	3.48E+10	3.53E+10	3.47E+10	3.52E+10	6.20E+10	3.50E+10	3.61E+10
EA-VF-UNM (STC-8)	1.01E+10	1.01E+10	9.34E+09	1.01E+10	1.01E+10	1.01E+10	1.02E+10	9.99E+09	1.01E+10	2.15E+10	9.95E+09	1.03E+10
EI-VF-SPR (STC-9)	2.70E+08	2.69E+08	2.66E+08	2.70E+08	2.72E+08	2.65E+08	2.69E+08	1.68E+08	2.70E+08	3.30E+08	2.68E+08	2.71E+08
EI-VF-UNH (STC-10)	1.83E+10	1.83E+10	1.59E+10	1.83E+10	1.85E+10	1.82E+10	1.83E+10	1.74E+10	1.83E+10	3.58E+10	1.81E+10	1.84E+10
EI-VF-UNM (STC-11)	4.02E+09	4.02E+09	3.95E+09	4.02E+09	4.04E+09	4.01E+09	4.08E+09	4.60E+09	4.02E+09	5.32E+09	3.91E+09	4.35E+09

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
EI-VI-SPR (STC-12)	4.12E+06	3.74E+06	3.82E+06	4.12E+06	4.12E+06	4.12E+06	4.12E+06	4.08E+06	4.12E+06	4.12E+06	4.13E+06	4.11E+06
EI-VI-UNM (STC-13)	5.88E+07	5.83E+07	5.50E+07	5.88E+07	5.93E+07	5.83E+07	5.87E+07	3.74E+07	5.88E+07	6.23E+07	5.83E+07	5.89E+07
EP-VF-SPR (STC-14)	1.62E+08	1.62E+08	1.61E+08	1.62E+08	1.63E+08	1.59E+08	1.61E+08	1.04E+08	1.62E+08	1.95E+08	1.61E+08	1.65E+08
EP-VF-SUP (STC-15)	3.33E+08	3.33E+08	5.83E+08	3.33E+08	3.38E+08	3.30E+08	3.33E+08	8.90E+08	3.33E+08	4.34E+08	3.30E+08	3.63E+08
EP-VF-UNH (STC-16)	2.28E+10	2.28E+10	2.16E+10	2.28E+10	2.28E+10	2.24E+10	2.29E+10	2.35E+10	2.28E+10	4.18E+10	2.26E+10	2.33E+10

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
EP-VF-UNM (STC-17)	6.23E+09	6.23E+09	5.59E+09	6.23E+09	6.27E+09	6.21E+09	6.25E+09	5.91E+09	6.23E+09	1.24E+10	6.09E+09	6.34E+09
EP-VI-SPR (STC-18)	6.20E+07	6.16E+07	6.10E+07	6.20E+07	6.53E+07	6.18E+07	6.21E+07	4.50E+07	6.20E+07	6.82E+07	6.20E+07	6.32E+07
LA-VF-UNH (STC-19)	3.55E+10	3.55E+10	3.17E+10	3.55E+10	3.60E+10	3.51E+10	3.57E+10	3.24E+10	3.55E+10	5.02E+10	3.52E+10	3.62E+10
LA-VF-UNM (STC-20)	3.55E+10	3.55E+10	3.17E+10	3.55E+10	3.60E+10	3.51E+10	3.57E+10	3.24E+10	3.55E+10	5.02E+10	3.52E+10	3.62E+10
LP-VF-SPR (STC-21)	1.38E+08	1.38E+08	1.41E+08	1.38E+08	1.41E+08	1.36E+08	1.39E+08	7.40E+07	1.38E+08	1.74E+08	1.38E+08	1.40E+08

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
LP-VF-SUP (STC-22)	1.98E+09	1.98E+09	2.30E+09	1.98E+09	1.99E+09	1.98E+09	2.01E+09	2.85E+09	1.98E+09	2.25E+09	1.94E+09	2.07E+09
LP-VF-UNH (STC-23)	2.16E+10	2.16E+10	1.99E+10	2.16E+10	2.17E+10	2.13E+10	2.18E+10	2.20E+10	2.16E+10	4.02E+10	2.13E+10	2.22E+10
LP-VF-UNM (STC-24)	1.02E+10	1.02E+10	8.79E+09	1.02E+10	1.03E+10	1.01E+10	1.02E+10	9.67E+09	1.02E+10	1.89E+10	1.00E+10	1.03E+10
LV-VF-SPR (STC-25)	1.17E+08	1.16E+08	1.12E+08	1.17E+08	1.17E+08	1.15E+08	1.18E+08	7.24E+07	1.17E+08	1.31E+08	1.17E+08	1.18E+08
LV-VF-SUP (STC-26)	1.57E+09	1.57E+09	1.68E+09	1.57E+09	1.59E+09	1.67E+09	1.58E+09	1.62E+09	1.57E+09	1.84E+09	1.55E+09	1.75E+09

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
LV-VF-UNH (STC-27)	2.46E+10	2.46E+10	2.28E+10	2.46E+10	2.49E+10	2.47E+10	2.48E+10	2.45E+10	2.46E+10	4.62E+10	2.42E+10	2.53E+10
LV-VF-UNM (STC-28)	3.53E+09	3.53E+09	3.44E+09	3.53E+09	3.47E+09	3.54E+09	3.56E+09	4.51E+09	3.53E+09	4.03E+09	3.31E+09	3.80E+09
TA-VF-UNM (STC-29)[1]	2.46E+10	2.46E+10	2.63E+10	2.46E+10	2.48E+10	2.40E+10	2.46E+10	2.31E+10	2.46E+10	5.33E+10	2.42E+10	2.48E+10
TP-VF-SPR (STC-30)[1]	3.68E+08	3.68E+08	5.87E+08	3.68E+08	3.74E+08	3.63E+08	3.68E+08	5.89E+08	3.68E+08	4.55E+08	3.64E+08	3.71E+08
TP-VF-SUP (STC-31)[1]	3.68E+08	3.68E+08	5.87E+08	3.68E+08	3.74E+08	3.63E+08	3.68E+08	5.89E+08	3.68E+08	4.55E+08	3.64E+08	3.71E+08

	Base Case	Sensitivity Cases										
CET End Point (Release Mode)	CASE 1 BASE 99.5% Evac	CASE 2 90% Evac	CASE3 -50% Timing	CASE 4 DLTSHL =5400	CASE 5 Min Mixing Layer Height	CASE 6 Max Mixing Layer Height	CASE 7 PLHEAT 1E+06	CASE 8 PLHEAT 1E+10	CASE 9 PLHEAT 1E+03	CASE 10 TIMDEC & CDNFRM Max Values	Case 11 PLHITE 0 m	Case 12 PLHITE 44.8 m
TP-VF-UNM (STC-32) [1]	1.04E+10	1.04E+10	9.48E+09	1.04E+10	1.05E+10	1.04E+10	1.04E+10	1.04E+10	1.04E+10	1.93E+10	1.02E+10	1.08E+10
Relative Change (%)	-	0.0%	-7.1%	0.0%	1.0%	-1.1%	0.5%	-2.7%	0.0%	74.1%	-1.2%	2.1%

Note:

1. ATWS STC scenarios (STC-29, -30, -31, and -32) from plant damage state (PDS) 4 are mapped to surrogate STCs from PDS 2 (STC-3, -5, -5, and -6 respectively) [Reference 7]: Results in Tables 10-1 through 10-4 for the surrogate STC are assumed representative of the ATWS STC in this analysis.

The results from the eleven (11) sensitivity cases for population dose and offsite economic cost from Tables G1.4-12 and G1.4-13 were compared individually against the base model results of Case 1 and are summarized below.

Population Dose

Sensitivity Case 3 (50 percent reduction in timing parameters), Case 5 (minimum mixing layer heights), Case 10 (maximum values for time to complete decontamination and non-farmland decontamination costs for MACCS2 decontamination factor (DF)15) and Case 12 (plume release height at top of containment – 44.8m) show the highest increase in population dose when compared to the base case, though only a small increase. Case 10 shows the largest of the increases, though only decontamination costs are increased. This result shows that changes in these decontamination cost parameters not only affects the economic costs due to a severe accident, but also the amount of population dose received. This is because the decontamination costs affect the habitability decision making performed by the WinMACCS software for the land area: is the land immediately inhabitable, will the land be habitable after decontamination, or will the land be habitable after a both decontamination and interdiction? These evaluations of habitability are integral in determining the amount of population dose and economic costs attributed to decontamination, interdiction, and condemnation of property calculated by the software. Therefore, this sensitivity case also shows that changes in decontamination cost parameters can also impact calculated population dose in addition to economic cost (SAND 1998). Cases 5 and 12 show an even smaller increase in population dose.

Sensitivity Case 6 (maximum mixing layer heights) and Case 8 (plume heat 1E+10 watts) each show a decrease in population dose when compared to the base case. These results do not translate into a significant change in population dose and would not impact the overall conclusion of the severe accident mitigation design alternatives (SAMDA) analysis. All other cases show a very small to no change in population dose when compared to the base case.

Offsite Economic Costs

Sensitivity Case 10 (maximum values for time to complete decontamination and non-farmland decontamination costs for MACCS2 DF15) and Case 12 (plume release height at top of containment – 44.8m) show the highest increase in offsite economic costs when compared to the base case. Case 10 shows the largest increase across the STCs, which are approximately double the base case values. Cases 5, 7, and 12 show an even smaller increase in offsite economic costs when compared to the base case.

Sensitivity Case 3 (50 percent reduction in timing parameters), Case 6 (maximum mixing layer heights), Case 8 (plume heat 1E+10 watts), and Case 11 (plume release height at ground level – 0m) show a decrease in offsite economic costs when compared to the base case. This result does not translate into a significant increase or decrease in offsite economic costs and would not impact the overall conclusion of the severe accident mitigation design alternatives (SAMDA) analysis. Sensitivity Case 3 shows the most significant decrease in offsite economic costs when compared to the base case results, with sensitivity Case 6 and Case 11 showing an even smaller decrease compared to the base case results. All other cases show a very small to no change in economic costs when compared to the base case.

Sensitivity Analysis Summary

The results of these sensitivity cases do not translate into a significant increase or decrease in population dose or offsite economic costs and would not impact the overall conclusion of the severe accident mitigation design alternatives (SAMDA) analysis.

G.2 EVALUATION OF PNPP SAMA CANDIDATES

This section describes the generation of the initial list of potential SAMA candidates, screening methods and the analysis of the remaining SAMA candidates. The assessment utilizes the guidance from NEI 05-01 (NEI 2005). The guidance provides for a two-phase process with Phase I being the initial identification and qualitative screening process. Phase II extends the work to develop a more refined quantification cost benefit evaluation.

G.2.1 SAMA LIST COMPILATION

The list of candidate SAMAs for the PNPP LR was developed from industry and plant-specific sources. NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)” (NRC 1996a) includes the supplemental environmental impact statements that licensees were required to prepare to address potential environmental impacts and mitigation measures for 23 issues requiring plant-specific review. Potentially cost-beneficial SAMAs were identified by licensees as part of this review and are documented in these plant-specific supplements. Copies of the plant-specific supplements were obtained from the NRC website NRC 1996b. The industry SAMA review included 129 SAMAs from other units.

In addition to the industry SAMAs, the current effort re-evaluated the 25 PNPP SAMA candidates that were previously developed in an initial PNPP SAMA cost-benefit analysis. Three new plant-specific SAMAs were identified by the expert panel to be evaluated, resulting in a total of 157 PNPP SAMA candidates.

G.2.2 QUALITATIVE SCREENING OF SAMA CANDIDATES

The purpose of the qualitative screening conducted in Phase I is to use high-level knowledge of the plant and SAMAs to preclude the need to perform detailed cost-benefit analysis. Since many of the SAMAs were derived from industry sources, they include a variety of potential plant improvements to support enhanced severe accident management.

SAMAs were screened using three qualitative screening steps and two bounding quantitative steps and eliminated from consideration using the following criteria defined in NEI 05-01 (NEI 2005).

1. **Applicable to Plant**: PNPP is a General Electric (GE) boiling water reactor (BWR) type 6, the scope of the search for applicable SAMAs was limited to these designs and those not applicable were screened out. For example, SAMAs for pressurized water reactors (PWRs) were not considered. Similarly, SAMAs applicable to multiunit designs were also screened out. For SAMAs related to external events, suggested improvements may be indicative of some similar scenarios, but the actual improvement is very plant-specific and cannot be applied globally. These were screened out. PNPP SAMAs related to external event results are addressed by the site-specific selection.

2. **Already Implemented**: If the SAMA was already implemented at PNPP or the PNPP design meets the intent of the SAMA, the SAMA was screened out.

3. **Can be Combined with Other SAMA(s)**: If SAMAs are similar in nature, they are combined with like SAMAs representing the most bounding case and the other SAMAs are screened out. This approach allows for bounding cases that completely address a plant risk contributor to be defined to estimate the maximum possible benefits.

4. **Excessive Implementation Cost**: If the cost of the SAMA has been shown to clearly be excessive (such as replacing the reactor vessel) the SAMA may be screened out. Section G.1.4 defines the maximum benefit (MB) for internal events/internal flooding and seismic. These values represent a conservative upper bound benefit for risk reduction. Based on a review of SAMA and relative contributions to CDF addressed by the SAMA, the MB was reduced by 50 percent to provide a more realistic estimate of expected benefit. If the estimated implementation costs exceeded this 50 percent MB value, the SAMA was screened out.

5. **Very Low Benefit**: This screening step considered how the SAMA would influence the various hazard models and estimated the risk reduction. If the risk gain was determined to be limited due to small or no measurable contribution to the risk profile for PNPP the SAMA was screened out.

The Phase I qualitative screening performed in steps 1-3 significantly reduced the list of candidate SAMAs. Following these qualitative screening steps, the unscreened SAMA candidates were grouped into twelve SAMA candidate groups provided in Table G2-1 for steps 4 and 5. These twelve SAMA candidate groups were carried forward to Steps 4 and 5.

Table G2-1 SAMA Group for Phase I Steps 4 and 5 Evaluation

PNPP SAMA Group	SAMA Group Description	Assessment	Generic Case (if applicable)
SAMA-2	This SAMA would provide an automatic initiation of suppression pool cooling during a transient. An automatic initiation would remove the burden on operators for manual alignment and initiation of suppression pool cooling.	Found not to be cost effective in Reference 6. However, retained based on updated results.	AUTO_SPC
SAMA-3	This SAMA would provide a dedicated passive containment vent flow path. A rupture disk would be installed with a failure pressure below the ultimate containment strength to allow the disk to fail prior to containment failure. A dedicated passive containment vent would remove the burden on operators for manual alignment and initiation of containment venting.	Found to be large reduction in Reference 6 and cost effective, although significant costs involved.	PASS_CV
SAMA-5	This SAMA would provide a Pre-Action Type Fire Protection Piping in the Control Complex, replacing the existing 4" "wet type" fire protection piping in the Control Complex. This modification would reduce the frequency of a series of flooding initiators in the Control Complex.	Internal Flooding represents approximately 65% of CDF and is dominated by floods in the control complex. This option was not found to be cost effective, but could be addressed in other manners, such as flood doors.	FLOOD_ISOLATE

PNPP SAMA Group	SAMA Group Description	Assessment	Generic Case (if applicable)
SAMA-6	This SAMA would provide a higher curb at the Reactor Water Cleanup Valve Room/Reactor Core Isolation Cooling room interface and a breakaway door at AX-303 to the Turbine Power Complex. These modifications would reduce the consequences of a series of flooding initiators in the Unit 1 Auxiliary Building 599' elevation.	This is similar to SAMA-5 in that it addresses AB flooding. Found to be cost effective for the 95%-tile assessment in Reference 6.	
SAMA-7	This SAMA would enhance the reliability of the Emergency DC Power Supply. For long term SBO scenarios, the battery life with crosstie to Unit 2 and credit for load shedding is about 24 hours. However, for internal flooding scenarios and internal fires where there may be no ready access to the Unit 1 batteries (and crosstie to Unit 2 batteries), the battery life may only be about 4 hours. After battery depletion, the SRVs will close and the RPV will re-pressurize and prevent injection with a low-pressure system, such as the fire protection system. Emergency DC power via a portable generator to supply power to the ADS valves already exists at Perry. However, in several flooding (and fire) scenarios this alternative is not optimum and contributes significantly to the core damage scenarios. Enhancing the reliability of emergency DC power for flooding and fire scenarios by hardware and procedural changes could improve the means of maintaining the ADS valves open and ensure RPV pressure remains low enough for use of low-pressure alternate makeup systems for the long-term.	Reference 6 found this beneficial based on 95%-tile PRA results. Retain for evaluation. However, since this is limited to internal flooding events, SAMA-5 could have an impact on any beneficial risk reduction.	

PNPP SAMA Group	SAMA Group Description	Assessment	Generic Case (if applicable)
SAMA-8	This SAMA would provide a faster means of alternate injection via fire water. This would address transients in which high pressure injection failed early and the operators were able to emergency depressurize to allow fire water injection prior to core damage. One approach is to hard pipe diesel fire pump to the reactor pressure vessel. This SAMA involves a hardware modification to allow the diesel fire pump to provide injection to the reactor pressure vessel (RPV).	Potential SAMA for Perry. Perry includes Fast Fire Water injection EOP-SPI 4.6, which requires deployment of fire hose. Reference 6 defines SAMA 11 that addresses the enhanced response time. Retain for evaluation.	FAST_DFP
SAMA-10	This SAMA would provide an automatic Termination & Prevention of injection during an Anticipated Transient Without Scram (ATWS). For failure to scram conditions, early reduction in RPV level is important to limit the heat load sent to the containment, the reliability of which could be improved by automating the reduction of RPV level as appropriate and the performance of the “terminate and prevent” step (to disallow automatic RPV makeup from non-feedwater sources).	ATWS is a small contributor, and the change was not found to be cost beneficial in Reference 6. However, the item is found in the generic SAMAs and if internal flooding is reduced, ATWS would be more important. Retain for evaluation.	
SAMA-11	This SAMA would provide alternate cooling to the EDG Rooms. The cooling would dissipate heat generated by the Emergency Diesel Generators in the event of a loss of normal cooling.	Reference 6 found this SAMA not cost beneficial. However, several other sites have identified this as an important SAMA. Therefore, it is retained for assessment.	EDG_HVAC

PNPP SAMA Group	SAMA Group Description	Assessment	Generic Case (if applicable)
SAMA-12	This SAMA would provide the ability to crosstie Emergency Service Water (ESW) pump A, 1P45C0001A, to the ESW B piping and vice versa, for cases that one train of ESW is available when the corresponding train of Emergency Closed Cooling Water (ECCW) system or Residual Heat Removal (RHR) are unavailable or otherwise failed while the other train of ECCW and RHR are available, but that train's ESW pump is not available. This crosstie capability would enable suppression pool cooling and containment spray for containment heat removal.	This SAMA was found to be cost beneficial in Reference 6. It is also identified in several other SAMA assessments. Retain for evaluation.	CROSS_SW
SAMA-14	Use fire-fighting water as a backup for containment spray: This SAMA would provide redundant containment spray function without the cost of installing a new system.	Potential SAMA. Reference 6 identified SAMA 26 but did not describe the source of alternative containment spray.	ALT_CSPRAY
SAMA-16	Automate SBLC initiation	Potential SAMA for Perry. ATWS represents ~2% of LERF contributions (Reference 7).	AUTO_SLC
SAMA-17	Develop procedures to repair or replace failed 4-kV breakers.	Quantitatively evaluate SAMAs that eliminate impact of loss of 4.16 kV bus. Expand the evaluation to flood and seismically induced initiators.	BRK_REPAIR

G.2.3 SCREENING EVALUATION FOR STEPS 4 AND 5 (PHASE I)

NEI 05-01 guidance qualitatively assesses the implementation cost and the net risk benefit (NEI 2005). To provide a more robust assessment, a bounding quantitative assessment was performed to support the qualitative decision to screen out a SAMA candidate.

To develop the cost estimate and risk model, it was necessary to develop a conceptual implementation of the proposed SAMA in a manner that achieves the same improvement for the PNPP site as proposed by the SAMA group. From this concept, the cost estimate is generated and the changes to the PNPP PRA model are defined. The costing process and the proposed design were developed based on input and review from the PNPP expert panel.

CDF and LERF may be chosen as metrics based on the guidance in Regulatory Guide 1.174 (NRC 2018) which states that CDF and LERF are acceptable surrogates for us in assessing the USNRC commission's safety goal qualitative health objectives (QHOs). CDF is a surrogate for latent cancer fatality risk and LERF is a surrogate for individual early fatality risk.

However, Phase II requires a Level 3 PRA to support the averted cost-risk calculations (NEI 2005). Since the model was available, the Level 3 PRA model developed the dose estimates. The Level 3 model utilizes the Level 2 PRA frequency and deterministic outputs and includes updates to the population density within 50 miles of the PNPP site, economic data reflecting recent cost data, meteorological data, and plant emergency response information (detailed in Section X) as input to Version 3.10.0 of the Windows Interface for MACCS2, MELCOR Accident Consequence Code System (WinMACCS). The model inputs are based on nuclide release information that reflects the current fission product inventory and frequency information for plant source term categories (STCs).

The resulting calculated public dose, environmental consequences, and replacement power costs were used to determine a total maximum benefit (MB) and a MB for each hazard model using the calculational approach defined in NEI 05-01 (NEI 2005).

The MB provides the total dollar value associated with removal of all identified risk. It represents the highest monetary value available for making changes and, therefore, the MB bounds any specific change that may be defined by any SAMA.

The use of 100 percent of the MB was considered overly conservative a measure based on the maximum potential impact on CDF and LERF from any single SAMA. A review of the PNPP risk contributions for CDF and LERF found that no single SAMA would be expected to result in a 50 percent risk reduction. The maximum contribution was approximately 40 percent for SAMA 17. This upper limit is used as the basis for reducing the MB by 50 percent for the comparison. If the cost of implementation exceeded fifty percent of the MB, the SAMA was screened out.

In performing the quantitative evaluation, the PNPP Level 2 model is used to support release category classification. CDF and LERF are determined from the Level 2 model in the following manner. The CDF is the input to the Level 2 model and all frequency is partitioned between the various release categories. Therefore, the quantification of the Level 2 top gate (@L2) includes all release categories and the quantified result must be the estimation of CDF.

LERF can be determined using the model flag FLAG-LERF. Since all release categories are independent and only one may appear in any given cut set, the frequency contribution for LERF is determined by multiplying the release category importance defined by the release category basic event's Fussell-Vesely by the CDF. Other release categories (SERF, LERF, LRF, INTACT) are developed using the same technique.

Total dose is selected as a surrogate to the detailed cost-benefit assessment. Dose is the input to many aspects of the evaluation, and it provides a good indication as to the risk reduction impact in relation to the allowable cost. Table G2-2 summarizes the baseline results of these metrics by hazard. Note that internal events and internal flooding results are quantified together and are reported together.

The Level 2 top gate (gate @L2) of the PNPP model was quantified to obtain the metrics in the table. The internal events/internal flooding model was quantified at a frequency truncation of 3.0E-13/y. The seismic model was quantified using a truncation of 2.0E-10/y. Conservatism contained in the seismic model due to high probability contributions was reduced using the ACUBE application. The ACUBE solution applied the binary decision diagram method for the 3000 highest frequency cut sets. The number of cut sets evaluated was based on a sensitivity assessment that considered frequency refinement versus quantification time.

Table G2-2 PNPP Baseline Results

Hazard	CDF (/y)	LERF (/y)	Dose (REM/y)
Internal Events and Internal Flooding	1.32E-6	1.88E-7	1.70E+1
Seismic	1.46E-5	5.19E-6	2.78E+2
Total	1.59E-5	5.38E-6	2.95E+2
Seismic Contribution to Total	91.7%	96.5%	94.2%

This information is utilized to support Step 4 and Step 5 of the Phase I screening process. For convenience, the order of these two steps is reversed. This has no impact on the implementation guidance.

G.2.3.1 Step 5: Very Low Benefit Screening for SAMA

Table G2-2 shows that the seismic contribution dominates the results for all three metrics. A consequence of this insight is that any SAMA improvement limited to internal events and/or internal flooding will only provide a small risk reduction and low benefit.

This insight as well as other aspects of the SAMA provides a significant preliminary qualitative screening metric. The SAMAs are examined to determine if they apply to all hazards or are specifically targeted toward specific hazards. The SAMA description is compared to the risk contributions for each of the three hazard categories. If it is determined that the SAMA has little or no impact on the risk contribution from the hazard, the column is labeled as having “No Impact.” Based on this examination, rules are applied for screening the SAMA. The rules are discussed below.

The most important screening rule is based on the prior insight that any SAMA that does not impact the seismic hazard cannot meet the maximum benefit criterion of a 50 percent reduction in risk. If the SAMA does not impact the seismic hazard results, the column is set to “No impact” and the SAMA is screened out. Note that the SAMA may impact the hazard risk contribution, but application given the current seismic risk contributions would result in an insignificant change in risk.

Some SAMAs only address a specific aspect of seismic, internal flooding or internal event scenarios and have no impact on the other hazards. In these cases, the excluded hazards are set to “No impact.” This is important in the next step when comparing the implementation cost to the maximum benefit value. The maximum benefit should only reflect the value associated with the impacted hazards.

When a design change is required, the change is assumed to not meet seismic Category 1. This reduces the implementation costs and is conservative. SAMA-17 is specific to seismic and is considered to require a design meeting at least seismic Category 1.

Unless specifically identified in the SAMA description, any SAMA that was assessed to impact either internal events or internal flooding was conservatively assumed to impact both hazards. The screening review is summarized in Table G2-3.

Table G2-3 Mapping of SAMA Impacts to Hazard Contribution

SAMA Number	SAMA Change Description	Internal Events	Internal Flooding	Seismic	Retain on Frequency
SAMA-2	Automate Suppression Pool Cooling	X	X	No Impact	Screen out
SAMA-3	Install Passive Containment Vent	X	X	No Impact	Screen out
SAMA-5	Install Flood Doors for Switchgear Rooms	No Impact	X	No Impact	Screen out
SAMA-6	Install Curbs for Switchgear Rooms	No Impact	X	No Impact	Screen out
SAMA-7	Enhance DC Power for Internal Flooding	X	X	No Impact	Screen out
SAMA-8	Hardpipe Diesel Fire Pump Injection	X	X	No Impact	Screen out
SAMA-10	Terminate Makeup on ATWS	X	X	No Impact	Screen out
SAMA-11	Add Alternative EDG Room Cooling	X	X	No Impact	Screen out
SAMA-12	Add ESW Cross Tie	X	No Impact	No Impact	Screen out
SAMA-14	Add Alternative Containment Spray (L2 only)	X	X	No Impact	Screen out
SAMA-16	Automate SLC	X	No Impact	No Impact	Screen out
SAMA-17	Increase Capacity of Relays	No Impact	No Impact	X	Retain

The table identifies that only one SAMA is considered potentially capable of providing a significant benefit (SAMA 17).

Another factor to consider is the relative cost of implementation. If the SAMA is low cost, it may be possible that it will meet the cost benefit threshold. The next section examines Step 4 of the process and examines implementation costs.

G.2.3.2 Step 4: Excessive Implementation Cost Screening for SAMA

Bounding calculations can be used to support the qualitative screening step 4 of Phase I.

The baseline risk averted cost is developed in Section G2.2.1. This value represents the maximum cost reduction given that all risk from the specific hazard is removed. This value is compared to the baseline risk averted cost when a hazard group is set to zero to identify the maximum reduction in frequency possible for that specific hazard group identified as the MB for the hazard. In Section G2.2.1, a basis is provided for reducing the MB by 50 percent for the comparison.

Based on the MBs defined in Section G2.2.1, if a SAMA is does not reduce the maximum benefit (MB) by 50 percent or more, the SAMA is screened out. The maximum benefit for the PNPP evaluation is based on the maximum change possible for a specific hazard group.

If the implementation cost of any SAMA is found to be less than 50 percent of the MB, the SAMA is retained for a more detailed evaluation in Phase II. Table G2-4 summarizes the results of the MB assessment for the hazard groups. Because some SAMAs are specific to internal flooding or internal event contributions, it also provides the MB for cases where the SAMA only impacts internal events or internal flooding.

Table G2-4 MB Assessment Results

Hazard Group	CDF	Maximum Benefit	50% MB
Internal Events and Internal Flooding	1.33E-06	$1,352,518	$676,259
Seismic	1.46E-05	$21,042,600	$10,521,300
Internal Events Only			$241,695
Internal Flooding Only			$434,564

For some specific SAMAs, the proposed modification only addresses internal flooding or internal events. It is necessary to adjust the MB based on the relative contributions of the specific hazard.

The status of the flooding tag in the cutset file was set from TRUE to 1.0 to determine the associated Fussell-Vesely importance. The importance was determined to be 0.643. The MB is reduced by this fraction for cases only involving internal flooding and by 0.357 (1-0.643) for cases only involving internal events. This results in a MB of $434,564 for internal flooding and $241,695 for the internal events

A review of the SAMAs was conducted to determine what hazard would be impacted by the proposed change.

This second screen was also applied, and the summary of information used for the assessment is provided in Table G2-5.

Table G2-5 Mapping of SAMA Costs to 50% Maximum Benefit

SAMA Number	SAMA Change Description	Implementation Cost	50% Maximum Benefit – Internal Events/Internal Flooding[1]	50% Maximum Benefit – Seismic[1]	Retain on Cost
SAMA-2	Automate Suppression Pool Cooling	$1,750,000	$676,259	NA	Screen out
SAMA-3	Install Passive Containment Vent	$3,950,000	$676,259	NA	Screen out
SAMA-5	Install Flood Doors for Switchgear Rooms	$270,000	$434,564	NA	Retain
SAMA-6	Install Curbs for Switchgear Rooms	$500,000	$434,564	NA	Screen out
SAMA-7	Enhance DC Power for Internal Flooding	$1,000,000	$676,259	NA	Screen out
SAMA-8	Hard Pipe Diesel Fire Pump Injection	$2,500,000	$676,259	NA	Screen out
SAMA-10	Terminate Makeup on ATWS	$1,750,000	$676,259	NA	Screen out
SAMA-11	Add Alternative EDG Room Cooling	$90,000	$676,259	NA	Retain
SAMA-12	Add ESW Cross Tie	$2,500,000	$241,695	NA	Screen out

SAMA Number	SAMA Change Description	Implementation Cost	50% Maximum Benefit – Internal Events/Internal Flooding[1]	50% Maximum Benefit – Seismic[1]	Retain on Cost
SAMA-14	Add Alternative Containment Spray (L2 only)	$620,000	$676,259	NA	Retain
SAMA-16	Automate SLC	$1,750,000	$241,695	NA	Screen out
SAMA-17	Increase Capacity of Relays	$6,892,100	NA	$10,521,300	Retain

1. Maximum benefit (MB) is defined as removal of the total contribution from that hazard. The actual reduction from any SAMA will be less than the MB. Inclusion of the MB is conservative.

2. Reduced to only account for internal flooding based on the focus and impact of the SAMA.

3. Reduced to only account for internal events based on the focus and impact of the SAMA.

The table identifies that four SAMAs are potentially cost effective when compared to 50 percent of MB.

The results of the two screening steps are summarized in Table G2-6.

Table G2-6 Step 4 and Step 5 Screening Summary

SAMA Number	SAMA Change Description	Step 4	Step 5	Final Outcome	Notes
SAMA-2	Automate Suppression Pool Cooling	Screen out	Screen out	Screen out	1,2
SAMA-3	Install Passive Containment Vent	Screen out	Screen out	Screen out	1,2
SAMA-5	Install Flood Doors for Switchgear Rooms	Screen out	Retain	Screen out	1
SAMA-6	Install Curbs for Switchgear Rooms	Screen out	Screen out	Screen out	1,2

SAMA Number	SAMA Change Description	Step 4	Step 5	Final Outcome	Notes
SAMA-7	Enhance DC Power for Internal Flooding	Screen out	Screen out	Screen out	1,2
SAMA-8	Hard Pipe Diesel Fire Pump Injection	Screen out	Screen out	Screen out	1,2
SAMA-10	Terminate Makeup on ATWS	Screen out	Screen out	Screen out	1,2
SAMA-11	Add Alternative EDG Room Cooling	Screen out	Retain	Retain	3
SAMA-12	Add ESW Cross Tie	Screen out	Screen out	Screen out	1,2
SAMA-14	Add Alternative Containment Spray (L2 only)	Screen out	Retain	Screen out	2
SAMA-16	Automate SLC	Screen out	Screen out	Screen out	1,2
SAMA-17	Increase Capacity of Relays	Retain	Retain	Retain	

1. Screened out due to the negative cost benefit based on implementation cost and MB.

2. Screened out due to the negligible impact for seismic and limited impact on SERF and LERF contributions leading to a very small benefit significantly smaller than 50 percent.

3. Retain due to the large difference in implementation cost to potential MB.

Based on this screening, only two SAMAs are moved forward into Phase II. The next section describes the evaluation process and the results of the activity.

G.2.4 QUANTITATIVE SCREENING AND COST BENEFIT EVALUATION OF SAMA CANDIDATES (PHASE II)

G.2.4.1 SAMA 11 Risk Reduction and Cost Benefit Assessment

This assessment addresses the employment of additional procedural guidance and equipment to provide alternative cooling to the Division 1 and Division 2 emergency diesel generators.

Model Implementation

The baseline model is altered to address the scope of the SAMA. The approach implemented assumes that the alternative HVAC is perfect in design and implementation. For the model, this is accomplished by gates GDBA112, GDBA312, GDBB112, GDBB313, and GDBC112 being set to false to guarantee the reliability of the respective divisions of the DG room ventilation.

Quantification

The Level 2 top gate of the PNPP model was quantified to obtain the release category frequency information. The quantification was limited to the internal events/internal flooding model since the change in the model would have no impact on the seismic risk estimate and the delta from that contribution is, by definition, zero. The internal events/internal flooding model was quantified at a frequency truncation of 3.0E-13/y.

Results Assessment

The breakdown of releases by release category (RC) is provided in Table G2-7 below.

Table G2-7 SAMA 11 Assessment Results by Release Category

Release Category	Frequency(/y)			Dose (mr)		
	Baseline	SAMA	Reduction (/y)	Baseline	SAMA	Reduction (/y)
BOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
L/E	1.88E-07	1.88E-07	6.39E-10	9.28E+00	9.24E+00	3.15E-02
L/I	3.69E-07	3.67E-07	2.93E-09	6.06E+00	6.01E+00	4.81E-02
M/I	6.82E-08	6.79E-08	3.21E-10	3.47E-01	3.46E-01	1.64E-03
M/L	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S/E	6.35E-07	6.13E-07	2.18E-08	1.31E+00	1.26E+00	4.50E-02
S/I	4.52E-09	5.60E-09	-1.08E-09	1.29E-02	1.59E-02	-3.07E-03

Release Category	Frequency(/y)			Dose (mr)		
	Baseline	SAMA	Reduction (/y)	Baseline	SAMA	Reduction (/y)
Intact	6.00E-08	7.45E-08	-1.45E-08	1.12E-01	1.39E-01	-2.69E-02
Total	1.33E-06	1.32E-06	1.02E-08	1.71E+01	1.70E+01	9.62E-02

The results of the cost-benefit assessment are summarized in Table G2-8 below.

Table G2-8 SAMA 11 Assessment Cost Benefit

SAMA	Averted Cost Benefit	Implementation Cost	Delta
SAMA 11	$6,637	$90,000	($83,363)

The cost to implement is estimated to be more than the potential averted costs and indicates that the proposed change is not cost-beneficial.

G.2.4.2 SAMA 17 Risk Reduction and Cost Benefit Assessment

This assessment addresses plant modifications to increase plant capability to eliminate seismic relay chatter for specific relays associated with the essential power supply system.

Model Implementation

The baseline model is altered to address the scope of the SAMA. The scope of the change is limited to the seismic hazard and the IEIF assessment is unchanged by this modification. The seismic model was altered to increase the seismic median capacity of selected relays to 10.0g. This essentially removes any contribution and simulates relay performance unaffected by the seismic event. The following changes (Table G2-9) were made to the baseline type code.

Table G2-9 Altered Relay Capacities

CAFTA Type Code	Median Capacity (g) (Rate)	CAFTA Model Description
EQ136P-AM	10.0	Relay 12IFC51A2A - Div 1/2 lockout, trip stub bus brkrs - Median Capacity
EQ136L-AM	10.0	Relay 12IFC66KD1A - Trip Loads off safety buses - Median Capacity
EQ136K-AM	10.0	Relay 12ICW52B - Actuate Div 3 Lockout - Median Capacity

CAFTA Type Code	Median Capacity (g) (Rate)	CAFTA Model Description
EQ136J-AM	10.0	Relay 12HFC22B2A - trip ESW/CCCW breakers - Median Capacity
EQ136G-AM	10.0	Relay ITE-50D - Div 3 AC Power - Median Capacity
EQ136F-AM	10.0	Relay 12IFC53A1A/12IFC53B1A - fail all AC (corr.) - Median Capacity
EQ136E-AM	10.0	Relay 12IFC53A1A/12IFC53B1A - fail AC - Median Capacity
EQ136C-AM	10.0	Relays 7803E/7805LR - Bus/EDG/Chiller Div 1/3 Lockout - Median Capacity

Quantification

The Level 2 top gate of the PNPP model was quantified to obtain the release category frequency information. The quantification was limited to the seismic model since the change in the model would have no impact on the internal events/internal flooding risk estimate and the delta from that contribution is, by definition, zero. The seismic model was quantified using a truncation of 2.0E-10/y. Conservatism contained in the seismic model due to high probability contributions was reduced using the ACUBE application. The ACUBE solution applied direct probability calculation methods for the 3000 highest frequency cut sets. The number of cut sets evaluated was based on a sensitivity assessment that considered frequency refinement versus quantification time.

Results Assessment

The breakdown of releases by release category (RC) is provided in Table G2-10 below.

Table G2-10 SAMA 17 Assessment Results by Release Category

Release Category	Frequency(/y)			Dose (mr)		
	Baseline	SAMA	Reduction (/y)	Baseline	SAMA	Reduction (/y)
BOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
L/E	5.19E-06	4.95E-06	2.37E-07	2.56E+02	2.44E+02	1.17E+01
L/I	2.21E-07	7.40E-08	1.47E-07	3.63E+00	1.21E+00	2.41E+00

Release Category	Frequency(/y)			Dose (mr)		
	Baseline	SAMA	Reduction (/y)	Baseline	SAMA	Reduction (/y)
M/I	6.42E-08	6.21E-08	2.07E-09	3.27E-01	3.16E-01	1.05E-02
M/L	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
S/E	9.04E-06	4.01E-06	5.03E-06	1.86E+01	8.26E+00	1.04E+01
S/I	4.64E-10	1.32E-09	-8.54E-10	1.32E-03	3.76E-03	-2.43E-03
Intact	6.44E-08	1.17E-07	-5.27E-08	1.20E-01	2.18E-01	-9.80E-02
Total	1.46E-05	9.21E-06	5.36E-06	2.78E+02	2.54E+02	2.44E+01

The results of the cost-benefit assessment are summarized Table G2-11 below.

Table G2-11 SAMA 17 Assessment Cost Benefit

SAMA	Averted Cost Benefit	Implementation Cost	Delta
SAMA 17	$1,675,769	$6,892,100	$(5,216,331)

The cost to implement is estimated to be significantly more and indicates that the proposed change is not cost beneficial.

G.2.4.3 Quantitative Screening of Unscreened SAMAs (Phase II)

The disposition of the two SAMAs evaluated in Phase II is summarized below in Table G2-12. The table indicates that both SAMAs are screened out by the quantitative screening process of Phase II. No SAMAs remain unscreened after this step. No SAMA is retained for potential implementation.

Table G2-12 Final Disposition of SAMAs Examined for PNPP

SAMA Number	SAMA Change Description	Final Disposition			
		Screened Out on Hazard Frequency Contribution	Screened Out on Maximum Benefit	Screened Out on Quantified Results	Retained
SAMA-2	Automate Suppression Pool Cooling	X	X		
SAMA-3	Install Passive Containment Vent	X	X		
SAMA-5	Install Flood Doors for Switchgear Rooms	X			
SAMA-6	Install Curbs for Switchgear Rooms	X			
SAMA-7	Enhance DC Power for Internal Flooding	X			
SAMA-8	Hard Pipe Diesel Fire Pump Injection	X	X		
SAMA-10	Terminate Makeup on ATWS	X	X		
SAMA-11	Add Alternative EDG Room Cooling	X		X	
SAMA-12	Add ESW Cross Tie	X	X		
SAMA-14	Add Alternative Containment Spray (L2 only)	X			
SAMA-16	Automate SLC	X	X		
SAMA-17	Increase Capacity of Relays			X	

G.3 BASELINE RISK-AVERTED COST

The unmitigated risk monetary value is calculated using the methodology given in NEI 05-01 (NEI 2005) for the performance of cost-benefit analyses. The value of unmitigated risk can be used to represent the maximum benefit that could be achieved if all risk was eliminated for operation of the PNPP events. The methodology of NEI 05-01 (NEI 2005) determines the present worth net value of public risk according to the following formula:

$$NPV = (APE + AOC + AOE + AOSC) - COE \qquad (1)$$

Where,

NPV = present value of current risk ($),

APE = present value of averted public exposure ($),

AOC = present value of averted offsite property damage costs ($),

AOE = present value of averted occupational exposure ($),

AOSC = present value of averted onsite costs ($),

COE = cost of any enhancement implemented to reduce risk ($).

The derivation of each of these costs is described in the subsections below. All equations used in the subsections below are taken from NUREG/BR-0184, which is the basis for the equations given in NEI 05-01 (NEI 2005; NRC 1997). The following specific values were used for various terms in the analyses:

Present Worth

The present worth was determined by:

$$PW = ([1-e^{(-rt)}])/r \qquad (2)$$

Where,

r is the discount rate = seven percent per year (assumed throughout these analyses)

t is the years remaining until end of plant life = 24 years

PW is the present worth of a string of annual payments of one dollar = $11.623

Dollars per REM

The conversion factor used for assigning a monetary value to on-site and off-site exposures was $2,000/person-rem averted. This is consistent with the U.S. NRC's regulatory analysis guidelines presented in and used throughout NEI 05-01 (NEI 2005.)

G.3.1 AVERTED PUBLIC EXPOSURE (APE)

Expected offsite doses from the internal events PRA accident sequences are presented in Tables G3-1 and G3-3. Costs associated with these doses were calculated using the following equation:

$$\mathrm{APE} = (F_S D_{PS} - F_A D_{PA}) \times R \times [1 - \mathrm{e}^{(-\mathrm{r}\mathrm{t}_\mathrm{f})}]/\mathrm{r} \qquad (3)$$

Where,

APE = present value of averted public exposure ($),

R = monetary equivalent of unit dose ($2,000/person-rem),

F_S = baseline accident frequency (events per year from Tables G3-1 and G3-3),

F_A = accident frequency after mitigation (0 events per year),

$F_S D_{PS}$ = baseline accident offsite frequency (person-rem per year from Tables G3-1 and G3-3),

$F_A D_{PA}$ = accident offsite dose frequency after mitigation (0 person-rem per year),

r = real discount rate (seven percent per year),

t_f = years remaining until end of plant life (24 years).

Using the values given above, APE is calculated for At-Power internal events with internal flooding and seismic events. Each of these calculations is detailed below.

G.3.1.1 APE for At-Power Internal Events and Internal Flooding Events

$APE_{(IEIF)}$ = (1.71E+01 person-rem per year – 0)×($2,000/person-rem)×((1 – $e^{-(0.07\times24)}$)/(0.07 per year))

= $ 397,855

G.3.1.2 APE for At-Power Seismic Events

$APE_{(SEIS)}$ = (2.78E+02 person-rem per year – 0)×($2,000/person-rem)×((1 – $e^{-(0.07\times24)}$)/(0.07 per year))

= $ 6,471,849

G.3.1.3 Total APE

$APE_{Tot} = APE_{(IEIF)} + APE_{(SEIS)}$

= $ 397,855+ $ 6,471,849

= $ 6,869,704

G.3.2 AVERTED PUBLIC OFFSITE PROPERTY DAMAGE COSTS (AOC)

Annual expected offsite economic risk is shown in Tables G3-2 and G3-4. The costs associated with AOC were calculated using the following equation:

$$\mathrm{AOC} = (F_S D_{DS} - F_A D_{DA}) \times \ [1 - \mathrm{e}^{(-\mathrm{rt_f})}]/\mathrm{r} \quad (4)$$

Where,

AOC = present value of averted offsite property damage costs ($),

$F_S D_{DS}$ = baseline accident frequency x property damage (cost per year from Tables G3-2 and G3-4),

$F_A D_{DA}$ = accident frequency x property damage after mitigation (0 event per year),

r = real discount rate (seven percent per year),

t_f = years remaining until end of plant life (24 years).

Using the values given above, AOC is calculated for At-Power internal events with internal flooding and seismic events. Each of these calculations is detailed below

G.3.2.1 AOC for At-Power Internal Events and Internal Flooding Events

$AOC_{(IEIF)}$ = ($ 76,093 per year – 0) × (1 – $e^{-(0.07 \times 24)}$) / (0.07 per year)

= $ 884,426

G.3.2.2 AOC for At-Power Seismic Events

$AOC_{(SEIS)}$ = ($ 1,187,391 per year – 0) × (1 – $e^{-(0.07 \times 24)}$) / (0.07 per year)

= $ 13,801,046

G.3.2.3 Total AOC

$AOC_{Tot} = AOC_{(IEIF)} + AOC_{(SEIS)}$

= $ 884,426+ $ 13,801,046

= $ 14,685,472

G.3.3 AVERTED OCCUPATIONAL EXPOSURE (AOE)

There are two types of occupational exposure due to accidents: immediate and long-term. Immediate exposure occurs at the time of the accident and during the immediate management of the emergency. Long-term exposure is associated with the cleanup and refurbishment or decommissioning of the damaged facility. The value of avoiding both types of exposure must be considered when evaluating risk.

The occupational exposure associated with severe accidents was assumed to be 23,300 person-rem/accident. This value includes a short-term component of 3,300 person-rem/accident and a long-term component of 20,000 person-rem/accident. These estimates are consistent with the "best estimate" values presented in Section 5.7.3 of NUREG/BR-0184 (NRC 1997). In calculating base risk, the accident-related onsite exposures were calculated using the best estimate exposure components applied over the on-site cleanup period. For onsite cleanup, the accident-related on-site exposures were calculated over a 10-year cleanup period. Costs associated with immediate dose, long-term dose and total dose are calculated below for At-Power internal events with internal flooding and seismic events. Each of these calculations is detailed below.

G.3.3.1 Averted Immediate Occupational Exposure Costs

Per the guidance of NEI 05-01, costs associated with immediate occupational doses from an accident were calculated using the following equation (NEI 2005):

$$W_{IO} = (F_S D_{IOS} - F_A D_{IOA}) \times R \times [1 - \mathrm{e}^{(-\mathrm{r t_f})}]/\mathrm{r} \quad (5)$$

Where,

W_{IO} =present value of averted immediate occupational exposure ($),

F_S =baseline accident frequency (events per year from Tables G3-1 and G3-3),

F_A =accident frequency after mitigation (0 events per year),

D_{IOS} =baseline expected immediate onsite dose (3300 person-rem/event),

D_{IOA} =expected occupational exposure after mitigation (3300 person-rem/event),

R =monetary equivalent of unit dose, ($2000/person-rem),

r =real discount rate (seven percent per year),

t_f = years remaining until end of plant life (24 years). (NEI 2005)

Using the values given above, W_{IO} is calculated for At-Power internal events with internal flooding and seismic events. Each of these calculations is detailed below:

G.3.3.1.1 WIO for At-Power Internal Events and Internal Flooding Events

$W_{IO(IEIF)}$ = ((1.33×10^{-6} events per year) × (3300 person-rem/event) – 0) × ($2000/person-rem) × (1 – e$^{-(0.07 \times 24)}$) / (0.07 per year)

=$ 102

G.3.3.1.2 W_{IO} for At-Power Seismic Events

$W_{IO(SEIS)}$ = ((1.46×10^{-5} events per year) × (3300 person-rem/event) – 0) × ($2000/person-rem) × (1 – e$^{-(0.07 \times 24)}$) / (0.07 per year)

= $ 1,118

G.3.3.2 Averted Long-Term Occupational Exposure Costs

Per the guidance of NUREG/BR-0184, costs associated with long-term occupational doses from an accident were calculated using the following equation:

$$W_{LTO} = (F_S D_{LTOS} - F_A D_{LTOS}) \times R \times [1 - \mathrm{e}^{(-\mathrm{rt_f})}]/\mathrm{r} \times [1 - \mathrm{e}^{(-\mathrm{rm})}]/\mathrm{r}\, m \quad (6)$$

Where,

W_{LTO} =present value of averted long-term occupational exposure ($),

F_S =baseline accident frequency (events per year from Tables G3-1 and G3-3),

F_A =accident frequency after mitigation (0 events per year),

D_{LTOS} =baseline expected long-term onsite dose (20,000 person-rem/event),

D_{LTOA} =expected occupational exposure after mitigation (20,000 person-rem/event),

R =monetary equivalent of unit dose, ($2000/person-rem),

r =real discount rate (seven percent per year),

m =years over which long-term doses accrue (10 years)

t_f =years remaining until end of plant life (24 years). (NRC 1997)

Using the values given above, W_{LTO} is calculated for At-Power internal events with internal flooding and seismic events. Each of these calculations is detailed below.

G.3.3.2.1 WLTO for At-Power Internal Events and Internal Flooding Events

WLTO for At-Power Internal Events and Internal Flooding Events

$W_{LTO(IEIF)}$ = ((1.33×10^{-6} events per year) × (20,000 person-rem/event) – 0) × ($2000/person-rem) × ((1 – e$^{-(0.07 \times 24)}$) / (0.07 per year)) × ((1 – e$^{-(0.07 \times 10)}$) / ((0.07 per year) × (10 years)))

=$ 445

G.3.3.2.2 WLTO for At-Power Seismic Events

$W_{LTO\ (SEIS)}$ = ((1.46x10^{-5} events per year) × (20,000 person-rem/event) – 0) × ($2000/person-rem) × ((1 – $e^{-(0.07 \times 24)}$) / (0.07 per year) × ((1 – $e^{-(0.07 \times 10)}$) / ((0.07 per year) × (10 years))

= $ 4,872

G.3.3.3 Total Averted Occupational Exposure Costs

As described in Section G4.3, the total cost associated with averted occupational exposure, AOE, is the sum of the costs associated with averted immediate exposure and the costs associated with the averted long-term exposure, or:

$$AOE = WIO + W_{LTO} \quad (7)$$

Total averted onsite exposure costs are calculated for At-Power internal events, internal flooding events, and fires, along with LPSD internal events, internal flooding events, and fires events. Each of these calculations is detailed below

G.3.3.3.1 AOE for At-Power Internal Events and Internal Flooding Events

$AOE_{(IEIF)}$ = $ 102 + $ 445

= $ 547

G.3.3.3.2 AOE for At-Power Seismic Events

$AOE_{(SEIS)}$ = $ 1,118 + $ 4,872

= $ 5,990

G.3.3.3.3 Total AOE

$AOE_{Tot} = AOE_{(IEIF)} + AOE_{(SEIS)}$

= $ 547 + $ 5,990

= $ 6,537

G.3.4 AVERTED ONSITE COSTS (AOSC)

NUREG/BR-0184 defines three types of costs associated with onsite property damage from an accident: cleanup and decontamination, long-term replacement power, and repair and refurbishment (NRC 1997). The value of avoiding each of these types of costs must be considered when evaluating risk. Total averted onsite property damage costs are the sum of the three types of costs. Calculation of onsite property damage costs is detailed in the sections that follow:

G.3.4.1 Averted Cleanup and Decontamination Costs

The estimated cleanup cost for severe accidents was defined in NUREG/BR-0184, Section 5.7.6.1, to be $\$1. \times 10^9$ /accident (undiscounted). Using the value of $\$1.5\times10^9$ /event and assuming, as in NUREG/BR-0184, that the total sum is paid in equal installments over a ten-year period, the present value of those ten payments for cleanup and decontamination costs for the cleanup period can be calculated as follows:

$$PV_{CD} = C_{CD}/m \times \{ \left[1 - e^{(-rm)}\right]/r\} \quad (8)$$

Where,

PV_{CD} = net present value of cleanup and decontamination for a single event (dollars)
C_{CD} = total undiscounted cost for single accident with constant year basis (dollars)
r = real discount rate (seven percent per year),
m = years over which long-term doses accrue (10 years)

PV_{CD} = (($\$1.5\times10^9$ /event) / (10 years)) × ((1 – $e^{-(0.07 \times 10)}$) / 0.07)

= $\$1.0787\times10^9$ (NRC 1997)

The present value of the costs over the cleanup period must be considered over the period of plant life. The net present value of averted cleanup costs over the plant life can be calculated using the following equation:

$$U_{CD} = (F_A - F_S) \times PV_{CD} \times [1 - e^{(-rt_f)}]/r \quad (9)$$

Where,

U_{CD} = present value of averted onsite cleanup costs (dollars)
F_S = baseline accident frequency (events per year from Tables G3-1 and G3-3),
F_A = accident frequency after mitigation (zero events per year),
r = real discount rate (seven percent per year),
t_f = years remaining until end of plant life (24 years).

Using the values given above, U_{CD} is calculated for At-Power internal events, internal flooding events, and fires, along with LPSD internal events, internal flooding events, and fires events. Each of these calculations is detailed below.

G.3.4.1.1 U_{CD} for At-Power Internal Events and Internal Flooding Events

$U_{CD(IE)}$ = (1.33×10^{-6} events per year – 0) × ($\$1.0787\times10^9$) × (1 – $e^{-(0.07 \times 24)}$) / (0.07 per year)

=$ 16,675

G.3.4.1.2 U_{CD} for At-Power Seismic Events

$U_{CD\ (Fld)}$ = (1.46×10^{-5} events per year – 0) × ($\$1.0787\times10^9$) × (1 – $e^{-(0.07 \times 24)}$) / (0.07 per year)

= $ 182,738

G.3.4.2 Averted Replacement Power Costs

Replacement power costs, U_{RP}, are an additional contributor to onsite costs and can be calculated in accordance with NUREG/BR-0184, Section 5.7.6.2 (NRC 1997). Since replacement power will be needed for that time period following a severe accident until the end of the expected generating plant life, long-term power replacement calculations have been used. PNPP currently has a net electrical output of 1277 MWe.

Replacement power cost calculations performed in NUREG/BR-0184 are based on the 910 MWe reference plant. In applying the methodology used in NUREG/BR-0184 to the PNPP design, the equation was scaled for the 1277 MWe output of PNPP. For discount rates between 5 percent and 10 percent, NUREG/BR-0184recommends that the present value of replacement power be calculated as follows:

$$PV_{RP} = \left[\frac{\$1.2x10^{8}\frac{Rated\ Power}{910MWe}}{r}\right] \times \left[1 - e^{(-rt_f)}\right]^2 / r \quad (10)$$

Where,

PV_{RP} = net present value of replacement power for a single event (dollars)
Rated Power = 1277 MWe for PNPP,
r = real discount rate (seven percent per year),
t_f = years remaining until end of plant life (24 years).

Using the values given above:

PV_{RP} = $(1.2x10^8 \times (1277\ MWe / 910\ MWe)) / (0.07\ per\ year) \times (1 - e^{-(0.07 \times 24)})^2$

= $ $1.593 x10^9$ (NRC 1997)

The replacement power costs "PV_{RP}" ($\$1.593 x10^9$) was adjusted to 2021 dollars by applying a ratio of the average BLS Producer Price Index for Electric Power from years 1993 and 2021. The Producer Price Index for Electric Power for 2021 is 222.8, and the Producer Price Index for Electric Power for 1993 is 128.6 (USBL 2021b). The 2021 dollars scaling factor is calculated as 222.8/128.6, which equals 1.73.

The replacement power costs "PV_{RP}" was also adjusted to reflect the true need for replacement capacity availability based on current operations. A more realistic capacity factor of 91.9 percent is used in lieu of the suggested 60-65 percent range reported in NUREG/BR-0184 (NRC 1997). This adjustment was applied as a simple multiplier derived by dividing 91.9 percent by 60 percent to get a value of 1.53.

$PV_{RP} = \$\ 1.593x10^9 \times (1.73) \times (1.53)$

$= \$\ 4.215x10^9$

To obtain the expected costs of a single event over the plant life, the following equation is used:

$$\mathrm{U_{RP}} = [F_S - F_A] \times \mathrm{PV_{RP}} \times [1 - \mathrm{e}^{(-\mathrm{rt_f})}]^2/\mathrm{r} \quad (11)$$

Where,

U_{RP} =net present value of replacement power over life of facility (dollars),
F_S =baseline accident frequency (events per year from Tables G3-1 and G3-3),
F_A =accident frequency after mitigation (0 events per year),
PV_{RP} = net present value of replacement power for a single event (dollars)
r = real discount rate (seven percent per year),
t_f = years remaining until end of plant life (24 years).

Using the values given above, U_{RP} is calculated for At-Power internal events, internal flooding events, and fires, along with LPSD internal events, internal flooding events, and fires events. Each of these calculations is detailed below

G.3.4.2.1 U_{RP} for At-Power Internal Events and Internal Flooding Events

$U_{RP(IE)}$ = (1.33×10^{-6} events per year – 0) × (\$ 4.215×10^{9}) × (1 – e $^{-(0.07 \times 24)}$)^2 / (0.07 per year)

=\$ 53,015

G.3.4.2.2 U_{RP} for At-Power Seismic Events

$U_{RP\ (Fld)}$ = (1.46×10^{-5} events per year – 0) × (\$ 4.215×10^{9}) × (1 – e $^{-(0.07 \times 24)}$)^2 / (0.07 per year)

= \$ 580,977

G.3.4.3 Averted Repair and Refurbishment Costs

It is assumed that the plant would not be repaired or refurbished; therefore, these costs are zero.

G.3.4.4 Total Averted Onsite Costs (AOSC)

Total averted onsite cost is the sum of cleanup and decontamination costs, replacement power costs, and the repair and refurbishment costs. Total averted onsite costs are calculated as follows:

$$\mathrm{AOSC} = U_{CD} + U_{RP} + 0 \quad (12)$$

Total averted onsite costs are calculated for At-Power internal events, internal flooding events, and fires, along with LPSD internal events, internal flooding events, and fires events. Each of these calculations is detailed below

G.3.4.4.1 AOSC for At-Power Internal Events and Internal Flooding Events

$AOSC_{(IE)}$ = \$ 16,675 + \$ 53,015

=\$ 69,690

A.3.4.4.2 AOSC for At-Power Seismic Events

$AOSC_{(Fld)}$ = \$ 182,738 + \$ 580,977

= \$ 763,715

A.3.4.4.3 Total AOSC

$AOSC_{Tot} = AOSC_{(IEIF)} + AOSC_{(SEIS)}$

= \$ 69,690+ \$ 763,715

= \$ 833,405

G.3.5 COST ENHANCEMENT (COE)

The cost of enhancement is used when measures are taken to reduce risk. By definition, such measures are taken at the beginning of any period considered, so no discounting is performed for the COE. For baseline risk, no measures have been taken to reduce risk, so:

COE = \$0

G.3.6 TOTAL UNMITIGATED BASELINE RISK

As described in Section G4, the total present worth net value of public risk is calculated according to the following formula:

NPV = (APE + AOC + AOE + AOSC) – COE (1)

Using the values calculated in Sections 4.1 to 4.5, total baseline risk is calculated:

NPV = (\$ 6,869,704 + \$ 14,685,472 + \$ 6,537 + \$ 833,405) – \$0

= \$ 22,395,118

This value can be viewed as the maximum risk benefit attainable if all core damage scenarios from internal events are eliminated over the 24 years of extended plant life.

G.3.7 DATA TABLES

The following data tables include the Baseline Accident Frequency and Property Damage values used as input to the calculation of the maximum benefit that could be achieved if all risk was eliminated for operation for PNPP.

Table G3-1 Full Power Internal Events and Internal Flooding Baseline Accident Frequency

FP-IEIF		Dose from WinMACCS2 Base Case 99.5% evac (Case 1)			
RC	Freq	SV	Rem	Sv/yr	REM/yr
BOC	0.00E+00	1.71E+05	1.71E+07	0.00E+00	0.00E+00
L/E	1.88E-07	4.93E+05	4.93E+07	9.28E-02	9.28E+00
L/I	3.69E-07	1.64E+05	1.64E+07	6.06E-02	6.06E+00
M/I	6.82E-08	5.09E+04	5.09E+06	3.47E-03	3.47E-01
M/L	0.00E+00	3.31E+04	3.31E+06	0.00E+00	0.00E+00
S/E	6.35E-07	2.06E+04	2.06E+06	1.31E-02	1.31E+00
S/I	4.52E-09	2.85E+04	2.85E+06	1.29E-0	1.29E-02
INTACT	6.00E-08	1.86E+04	1.86E+06	1.12E-03	1.12E-01
Totals	1.33E-06			1.71E-01	1.71E+01

Table G3-2 Full Power Internal Events and Internal Flooding Baseline Accident Frequency X Property Damage

FP-IEIF		Property Damage	
RC	Freq	Cond $	$/yr
BOC	0.00E+00	9.70E+10	$ 0
L/E	1.88E-07	2.23E+11	$ 41,960
L/I	3.69E-07	8.68E+10	$ 32,070
M/I	6.82E-08	1.41E+10	$ 962
M/L	0.00E+00	5.59E+09	$ 0
S/E	6.35E-07	1.13E+09	$ 717
S/I	4.52E-09	2.73E+09	$ 12
INTACT	6.00E-08	6.18E+09	$ 371
Totals	1.33E-06		$ 76,093

Table G3-3 Seismic PRA Baseline Accident Frequency

Seismic		Dose from WinMACCS2 Base Case 99.5% evac (Case 1)			
RC	Freq	SV	Rem	Sv/yr	REM/yr
BOC	0.00E+00	1.71E+05	1.71E+07	0.00E+00	0.00E+00
L/E	5.19E-06	4.93E+05	4.93E+07	2.56E+00	2.56E+02
L/I	2.21E-07	1.64E+05	1.64E+07	3.63E-02	3.63E+00
M/I	6.42E-08	5.09E+04	5.09E+06	3.27E-03	3.27E-01
M/L	0.00E+00	3.31E+04	3.31E+06	0.00E+00	0.00E+00
S/E	9.04E-06	2.06E+04	2.06E+06	1.86E-01	1.86E+01
S/I	4.64E-10	2.85E+04	2.85E+06	1.32E-05	1.32E-03
INTACT	6.44E-08	1.86E+04	1.86E+06	1.20E-03	1.20E-01
Totals	1.46E-05			2.78E+00	2.78E+02

Table G3-4 Seismic PRA Baseline Accident Frequency X Property Damage

Seismic		Property Damage	
RC	Freq	Cond $	$/yr
BOC	0.00E+00	9.70E+10	$ 0
L/E	5.19E-06	2.23E+11	$ 1,156,679
L/I	2.21E-07	8.68E+10	$ 19,195
M/I	6.42E-08	1.41E+10	$ 905
M/L	0.00E+00	5.59E+09	$ 0
S/E	9.04E-06	1.13E+09	$ 10,213
S/I	4.64E-10	2.73E+09	$ 1
INTACT	6.44E-08	6.18E+09	$ 398
Totals	1.46E-05		$ 1,187,391

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