PREFACE

The following describes the information location, layout, and editorial conventions in the Cooper Nuclear Station (CNS) License Renewal Application (LRA) (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 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," are referred to by the document number, i.e., NUREG-1801 and 10 CFR 54, respectively. References to the USAR are to the CNS Updated 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 2.2-4. Tables 2.2-1-A, 2.2-1-B and 2.2-3 list mechanical systems, electrical systems and structures, respectively, within the scope of license renewal. Tables 2.2-2 and 2.2-4 list the systems and structures, respectively, not within 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. The drawings are provided in a separate submittal.

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) 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 the format and content of NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 1, U.S. Nuclear Regulatory Commission, September 2005. The tables include comparisons with the evaluations documented in NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 1, U.S. Nuclear Regulatory Commission, September 2005.

Section 4 addresses time-limited aging analyses, 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 documents the determination that no plant-specific exemptions granted pursuant to 10 CFR 50.12 that are based on time-limited aging analyses as defined in §54.3 will remain in effect.

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 also included. Following issuance of the renewed license, the material contained in this appendix will be incorporated into the USAR. 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 (CLB) for the period of extended operation. Appendix B contains a comparison of site 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 Program (BWRVIP) Applicant Action Items. License renewal application action items identified in the corresponding Nuclear Regulatory Commission (NRC) safety evaluation (SE) 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.

Appendix E is the environmental information which fulfills the requirements of 10 CFR 54.23 and 10 CFR 51.53(c).

ABBREVIATIONS AND ACRONYMS

Abbreviation or Acronym	Description
AC	alternating current
ACD	auxiliary condensate drains
ACI	American Concrete Institute
ACSR	aluminum conductor steel reinforced
ADS	automatic depressurization system
AEM	aging effect/mechanism
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
AR	air removal
ARI	alternate rod insertion
ART	adjusted reference temperature
AS	auxiliary steam
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AWG	American wire gauge
B&PV	Boiler and Pressure Vessel
BTP	Branch Technical Position
BWR	boiling water reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Program
CASS	cast austenitic stainless steel
CD	condensate drain
CE	conducts electricity
CEOG	Combustion Engineering Owners Group
CF	condensate filter demineralizer; chemistry factors

Abbreviation or Acronym	**Description**
CFR	Code of Federal Regulations
CII	containment inservice inspection
CLB	current licensing basis
CM	condensate makeup
CNS	Cooper Nuclear Station
CO_2	carbon dioxide
CRD	control rod drive
CRE	control room envelope
CREF	control room emergency filter
CS	core spray
CST	condensate storage tank
Cu	copper
CUF	cumulative usage factor
C_VUSE	Charpy upper-shelf energy
CW	circulating water
DBA	design basis accident
DC	direct current
DCD	design criteria document
DG	diesel generator
DGDO	diesel generator fuel oil
DGJW	diesel generator jacket water
DGLO	diesel generator lube oil
DGSA	diesel generator starting air
ΔP	differential pressure
DW	demineralized water
DWST	demineralized water storage tank
EAC	equipment area cooling

Abbreviation or Acronym	**Description**
ECCS	emergency core cooling system
ECST	emergency condensate storage tank
EDI	electrol deionization
EFPY	effective full power years
EH	electro-hydraulic
EIC	electrical and instrumentation and control
EMA	equivalent margin analysis
EN	shelter or protection
EPRI	Electric Power Research Institute
EQ	environmental qualification
ERP	elevated release point
ES	extraction steam
ESF	engineered safety feature
ESST	emergency station service transformer
ext	external
FAC	flow-accelerated corrosion
FB	fire barrier
FC	flow control
FD	flow distribution
FDN	floor drains, non-radioactive
F_{en}	fatigue correction factor(s)
FERC	Federal Energy Regulatory Commission
FF	fluence factor
FLB	flood barrier
FLT	filtration
FLV	floodable volume
FP	fire protection
FPC	fuel pool cooling and cleanup

Abbreviation or Acronym	Description
ft-lb	foot-pound
FW	feedwater
GE	General Electric
GL	Generic Letter
GSI	Generic Safety Issue
HCU	hydraulic control unit
HELB	high-energy line break
HEPA	high-efficiency particulate air
HPCI	high pressure coolant injection
HS	heat sink
HT	heat transfer
HV	heating and ventilation
HVAC	heating, ventilation, and air conditioning
IA	instrument air
ID	inside diameter
IN	insulation (electrical)
INS	insulation
int	internal
IPA	integrated plant assessment
ISG	Interim Staff Guidance
ISI	inservice inspection
ISP	Integrated Surveillance Program
KV or kV	kilo-volt
LO	turbine generator lube oil—mech

Abbreviation or Acronym	**Description**
LOGT	turbine lube oil—instruments
LOCA	loss of coolant accident
LPCI	low pressure coolant injection
LPRM	local power range monitors
LR	license renewal
LRA	license renewal application
MB	missile barrier
MC	main condensate
MCM	thousand circular mils
MEB	metal-enclosed bus
MG	motor-generator
MIC	microbiologically influenced corrosion
MO	Missouri
MS	main steam
MSIV	main steam isolation valve
MUR	measurement uncertainty recapture
MWe	megawatts-electric
MWt	megawatts-thermal
N_2	nitrogen
NA	neutron absorption; not applicable
NB	nuclear boiler
NBI	nuclear boiler instrumentation
n/cm^2	neutrons per square centimeter
NDE	non-destructive examinations
NE	Nebraska
NEI	Nuclear Energy Institute
NESC	National Electrical Safety Code

Abbreviation or Acronym	**Description**
NFPA	National Fire Protection Association
Ni	nickel
NM	neutron monitoring
NMT	neutron monitoring—TIP
NPS	nominal pipe size
NRC	Nuclear Regulatory Commission
NSSS	nuclear steam supply system
OBE	operating basis earthquake
OE	operating experience
OG	off gas
OWC	optimum water chemistry
PAS	post-accident sample
PB	pressure boundary
PC	primary containment
pH	potential of hydrogen
PLT	plateout
PM	preventive maintenance
ppb	parts per billion
ppm	parts per million
PSPM	periodic surveillance and preventive maintenance
P-T	pressure-temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PW	potable water
PWR	pressurized water reactor
QA	quality assurance

Abbreviation or Acronym	Description
RCIC	reactor core isolation cooling
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
REC	reactor equipment cooling
RF	reactor feedwater
RFLO	reactor feedwater pump and turbine lube oil
RG	Regulatory Guide
RHR	residual heat removal
RHRSW	residual heat removal service water
RMP	radiation monitoring—process
RMV	radiation monitoring—vent
RPS	reactor protection system
RPV	reactor pressure vessel (synonymous with reactor vessel)
RR	reactor recirculation
RRLO	reactor recirculation—lube oil
RT_{NDT}	reference temperature (nil-ductility transition)
RVDL	relief valve discharge line
RVID	Reactor Vessel Integrity Database
RW	radioactive waste
RWCU	reactor water cleanup
SA	service air
SAMA	severe accident mitigation alternatives
S&PC	steam and power conversion
SBNI	standby nitrogen injection
SBO	station blackout
SC	structure or component
SCBA	self-contained breathing apparatus

Abbreviation or Acronym	Description
SCC	stress corrosion cracking
SE, SER	Safety Evaluation, Safety Evaluation Report
SGT	standby gas treatment
SLC	standby liquid control
SNS	support for Criterion (a)(2) equipment
SRE	support for Criterion (a)(3) equipment
SRSS	square root of the sum of the squares
SRV, S/RV	safety/relief valve
S/RVDL	safety/relief valve discharge lines
SS	site security; stainless steel
SSC	system, structure, or component
SSR	support for Criterion (a)(1) equipment
SSST	station startup system transformers
STR	structural integrity
STRSP	structural support
SW	service water
TAP	torus-attached piping
TEC	turbine equipment cooling
TG	turbine generator
TGF	turbine generator EH fluid
TIP	traversing incore probe
TLAA	time-limited aging analysis (analyses)
TSE	tools and servicing equipment
USAR	Updated Safety Analysis Report
USE	upper-shelf energy
UT	ultrasonic testing

Abbreviation or Acronym	Description
VFLD	vessel flange leak detection
yr	year
Zn	zinc
1/4 T	one-fourth of the way through the vessel wall measured from the internal surface of the vessel

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1.0 ADMINISTRATIVE INFORMATION

Pursuant to Part 54 of Title 10 of the Code of Federal Regulations (10 CFR 54), this application seeks renewal for an additional 20-year term of the facility operating license for Cooper Nuclear Station (CNS). The facility operating license (DPR-46) expires at midnight January 18, 2014. The application applies to renewal of the source, special nuclear, and by-product materials licenses that are combined in the facility operating license.

The application is based on guidance provided by the U.S. Nuclear Regulatory Commission in NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 1, September 2005, and Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," Revision 1, September 2005, and guidance provided by the Nuclear Energy Institute in NEI 95-10, *Industry Guidelines for Implementing the Requirements of 10 CFR 54 - The License Renewal Rule*, Revision 6, June 2005.

The license renewal application is intended to provide sufficient information for the NRC to complete its technical and environmental reviews pursuant to 10 CFR Parts 54 and 51, respectively. The license renewal application is designed to allow the NRC to make the findings required by 10 CFR 54.29 in support of the issuance of a renewed facility operating license for CNS.

1.1 GENERAL INFORMATION

The following is the general information required by 10 CFR 54.17 and 10 CFR 54.19.

1.1.1 <u>Name of Applicant</u>

Nebraska Public Power District

1.1.2 <u>Address of Applicant</u>

Nebraska Public Power District
P.O. Box 499
Columbus, NE 68602-0499

Nebraska Public Power District
1414 15th Street
Columbus, NE 68602

Address of Nuclear Facility

Cooper Nuclear Station
P.O. Box 98
Brownville, NE 68321-0098

Cooper Nuclear Station
72676 648A Avenue
Brownville, NE 68321

1.1.3 <u>Description of Business of Applicants</u>

Nebraska Public Power District is a public corporation and political subdivision of the State of Nebraska engaging in generation, transmission, distribution, and sale of electric energy. This entity is hereinafter referred to as “the Applicant.”

1.1.4 Legal Status and Organization

Nebraska Public Power District is a public corporation and political subdivision of the State of Nebraska. The principal office is located in Columbus, Nebraska.

Nebraska Public Power District is not owned, controlled, or dominated by any alien, a foreign corporation, or foreign government. Nebraska Public Power District makes this application on its own behalf and is not acting as an agent or representative of any other person.

The names and addresses of the board of directors of Nebraska Public Power District are as follows. Members of the board are all US citizens.

Dennis L. Rasmussen Chairman Lincoln, Subdivision 1	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Larry E. Linstrom First Vice Chairman North Platte, Subdivision 4	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Gary G. Thompson Second Vice Chairman Beatrice, Subdivision 8	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Mary A. Harding Secretary Lincoln, Subdivision 2	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Ronald W. Larsen Kearney, Subdivision 3	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Darrell J. Nelson Broken Bow, Subdivision 5	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Edward J. Schrock Holdrege / Elm Creek, Subdivision 6	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Ken L. Schmieding Seward, Subdivision 7	Nebraska Public Power District 1414 15th Street Columbus, NE 68602

Larry G. Kuncl Columbus, Subdivision 9	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Virgil L. Froelich Norfolk, Subdivision 10	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Wayne E. Boyd South Sioux City, Subdivision 11	Nebraska Public Power District 1414 15th Street Columbus, NE 68602

The names and addresses of the principal officers of Nebraska Public Power District are as follows. The principal officers are all US citizens.

Ronald D. Asche President and Chief Executive Officer	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Traci L. Bender Vice President, Finance, Risk Management, Rates, Chief Financial Officer and Treasurer	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
John C. McClure Vice President, Government Affairs and General Counsel	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Stewart B. Minahan Vice President, Nuclear and Chief Nuclear Officer	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Patrick L. Pope Vice President, Energy Supply, and Chief Operating Officer	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
Roy A. Steiner Vice President, Human Resources and Corporate Support	Nebraska Public Power District 1414 15th Street Columbus, NE 68602
M. Edward Wagner Vice President, Customer Services	Nebraska Public Power District 1414 15th Street Columbus, NE 68602

1.1.5 Class and Period of License Sought

The Applicant requests renewal of the facility operating license for CNS (facility operating license DPR-46) for a period of 20 years. The license was issued under Section 104b of the Atomic Energy Act of 1954 as amended. License renewal would extend the facility operating license from midnight January 18, 2014, to midnight January 18, 2034.

This application also applies to renewal of those NRC source materials, special nuclear material, and by-product material licenses that are subsumed or combined with the facility operating license.

1.1.6 Alteration Schedule

The Applicant does not propose to construct or alter any production or utilization facility in connection with this renewal application.

1.1.7 Regulatory Agencies with Jurisdiction

Regulatory agencies with jurisdiction over the station are listed below.

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

Nebraska Power Review Board
301 Centennial Mall South
P. O. Box 94713
Lincoln, NE 68509-4713

1.1.8 Local News Publications

The trade and news publications which circulate in the area surrounding CNS, 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, include the following.

Omaha World Herald
World Herald Square
Omaha, NE 68102-1138

Lincoln Journal-Star
P.O. Box 81609
926 P Street
Lincoln, NE 68508

Nemaha County Herald
P.O. Box 250
830 Central Avenue
Auburn, NE 68305

Rockport Atchison County Mail
300 South Main Street
Rock Port, MO 64482

Nebraska City News-Press
806 Central
Nebraska City, NE 64482

1.1.9 <u>Conforming Changes to Standard Indemnity Agreement</u>

10 CFR 54.19(b) requires that license renewal applications include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewal license." The current indemnity agreement (No. B-57) for CNS states in Article VII that the agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment to the agreement, which is the last to expire. Item 3 of the Attachment to the indemnity agreement, as revised by Amendment No. 4, lists CNS operating license number DPR-46. The Applicant requests that any necessary conforming changes be made to specify the extension of the agreement until the expiration of the renewed CNS facility operating license sought in the application. In addition, should the license number change upon issuance of the renewed license, the Applicant requests that conforming changes be made to Item 3 of the Attachment, and other sections of the indemnity agreement, as appropriate.

1.1.10 <u>Restricted Data Agreement</u>

This application does not contain restricted data or national security information, and the Applicant does not expect that any activity under the renewed license for CNS will involve such information. However, if such information were to become involved, the Applicant agrees to secure such information appropriately and not to 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 Parts 10 CFR 25 or 10 CFR 95, respectively.

1.2 PLANT DESCRIPTION

The CNS site is located on the west bank of the Missouri River between the villages of Brownville and Nemaha, Nebraska. The station is located on a section of land bounded by the Missouri River on the east and by land not owned by NPPD on the north, south, and west. The site area also includes a parcel of land in Atchison County, Missouri, on the east side of the Missouri River.

CNS uses a single cycle, forced circulation, boiling water reactor (GE BWR-4). General Electric Company (GE) furnished the nuclear steam supply system (NSSS) and Westinghouse Electric Corporation furnished the turbine generator set. The NSSS is licensed to generate 2419 megawatts-thermal (MWt), which corresponds to 830 megawatts-electric (MWe)[1]. The current facility operating license for CNS expires at midnight January 18, 2014.

The principal structures of the station consist of the reactor building, turbine building (including service area appendages), control building, controlled corridor, radwaste building, augmented radwaste building, intake structure, off-gas filter building, elevated release point, diesel generator building, multi-purpose facility, railroad airlock, drywell and suppression chamber, miscellaneous circulating water system structures (e.g., circulating water conduits, seal well), optimum water chemistry gas generator building, and office building.

1.MWe assumes a power factor of 0.85.

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

This chapter describes the process for identification of structures and components subject to aging management review (AMR) in the CNS integrated plant assessment (IPA). For those systems, structures, and components (SSCs) within the scope of license renewal, 10 CFR 54.21(a)(1) requires the license renewal applicant to identify and list structures and components subject to aging management review. Furthermore, 10 CFR 54.21(a)(2) requires that methods used to identify these structures and components be described and justified. Technical information in this section serves to satisfy 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. 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 components and structural components subject to aging management review (screening) are in Section 2.3 for mechanical systems, Section 2.4 for structures, and Section 2.5 for electrical and instrumentation and controls (EIC) systems.

Table 2.0-1 gives the definitions of component intended functions used in this application for components and structural components. Tables in the application may refer to either the intended function name or to the abbreviation.

The term "piping" in component lists includes pipe and pipe fittings (such as elbows and reducers).

The term "heat exchanger (shell)" may include the bonnet/channel head and tubesheet. In cases where the bonnet/channel head and tubesheet provide a unique material and environment combination, they will be uniquely identified as a separate component type.

Table 2.0-1
Component Intended Functions: Abbreviations and Definitions

Abbreviation	Intended Function	Definition
CE	Conducts electricity	Provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals.
EN	Shelter or protection	Provide shelter or protection to personnel and safety-related equipment (including high-energy line break (HELB), radiation shielding and pipe whip restraint).
FB	Fire barrier	Provide rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
FC	Flow control	Provide control of flow rate or establish a pattern of spray.
FD	Flow distribution	Provide distribution of flow.
FLB	Flood barrier	Provide protective barrier for internal or external flood events.
FLT	Filtration	Provide removal of unwanted material.
FLV	Floodable volume	Maintain boundary of a volume in which the core can be flooded and adequately cooled in the event of a breach in the nuclear system process barrier external to the reactor vessel.
HS	Heat sink	Provide heat sink during station blackout or design basis accidents (includes source of cooling water for plant shutdown).
HT	Heat transfer	Provide ability to transfer heat.
IN	Insulation (electrical)	Insulate and support an electrical conductor.
INS	Insulation	Provide insulating characteristics to reduce heat transfer.
MB	Missile barrier	Provide missile (internal or external) barrier.
NA	Neutron absorption	Absorb neutrons.
PB	Pressure boundary	Provide pressure boundary integrity such that adequate flow and pressure can be delivered or provide fission product barrier for containment pressure boundary. This function includes maintaining structural integrity and preventing leakage or spray for 10 CFR 54.4(a)(2).
PLT	Plateout	Provide holdup and plateout of fission products.
SNS	Support for Criterion (a)(2) equipment	Provide structural or functional support to nonsafety-related equipment whose failure could impact safety-related equipment (10 CFR 54.4(a)(2)).

Table 2.0-1 (Continued)
Component Intended Functions: Abbreviations and Definitions

Abbreviation	Intended Function	Definition
SRE	Support for Criterion (a)(3) equipment	Provide structural or functional support to equipment required to meet the Commission’s regulations for the five regulated events in 10 CFR 54.4(a)(3).
SSR	Support for Criterion (a)(1) equipment	Provide structural or functional support for safety-related equipment (10 CFR 54.4(a)(1)).
STR	Structural integrity	Maintain structural integrity of reactor vessel internals components such that loose parts are not introduced into the system.
STRSP	Structural support	Provide structural or functional support for reactor vessel or reactor vessel internals components.

2.1 SCOPING AND SCREENING METHODOLOGY

2.1.1 Scoping Methodology

The license renewal rule, 10 CFR 54 (Reference 2.1-1), defines the scope of license renewal. Section 54.4(a) requires systems, structures, and components (SSCs) to be in scope 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 shut down 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 the functions identified in paragraphs (1)(i), (ii), or (iii) of this section.

(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* (Reference 2.1-6), provides industry guidance for determining what SSCs are in the scope of license renewal. The process used to determine the systems and structures in the scope of license renewal for CNS followed the recommendations of NEI 95-10.

Consistent with NEI 95-10, the scoping process developed a list of plant systems and structures and identified their intended functions. Intended functions are those functions that are the basis for including a system or structure within the scope of license renewal (as defined in 10 CFR 54.4(b)) and are identified by comparing the system or structure function with the criteria in 10 CFR 54.4(a).

The CNS equipment database was used to develop a list of plant systems. The equipment database is a controlled list of plant systems and components. Components in the database have unique identifiers that include the system code assigned to the component.

For mechanical system scoping, a system is defined as the collection of components in the equipment database assigned to the system code. System functions are determined based on the functions performed by those components. Defining a system by the components in the database is consistent with the evaluations performed for maintenance rule scoping by the site.

Structural components included in system codes, such as fire doors in the FP (fire protection) system code, are included in the appropriate structural evaluation. Structural commodities associated with mechanical systems, such as pipe hangers and insulation, are evaluated with the structural bulk commodities.

For the purposes of system level scoping, plant electrical and instrumentation and control (EIC) systems are included in the scope of license renewal by default. EIC components in mechanical systems are included in the evaluation of EIC components, regardless of whether the mechanical system is included in scope. Intended functions for EIC systems are not identified since the bounding (i.e., included by default) scoping approach makes it unnecessary to determine if an EIC system has an intended function. Switchyard equipment, which is not part of the plant's EIC systems, was reviewed for station blackout (SBO) intended functions based on NRC guidance in NUREG-1800, Section 2.5.2.1.1. See Section 2.1.1.3.5 for further discussion of scoping for station blackout. See Section 2.5 for additional information on electrical scoping.

As the starting point for structural scoping, a list of plant structures was developed from a review of the USAR, site drawings, Fire Hazards Analysis, design criteria documents, and maintenance rule basis documents. The list includes structures that potentially support plant operations or could adversely impact structures that support plant operations (i.e., seismic II/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).

Intended functions for structures and mechanical systems were identified based on reviews of applicable plant licensing and design documentation. Documents reviewed included applicable sections of the USAR, maintenance rule basis documents, design criteria documents (DCDs) (including topical DCDs), the Fire Hazards Analysis, the Appendix R Safe Shutdown Analysis Report, Technical Specifications, and various station drawings as necessary.

Each structure and mechanical system was evaluated against the criteria of 10 CFR 54.4 as 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). Due to the bounding approach used for scoping EIC systems, a discussion of these systems in Sections 2.1.1.1, 2.1.1.2, and 2.1.1.3 is not necessary. The results of these evaluations for plant systems and structures are presented in Section 2.2.

2.1.1.1 Application of Safety-Related Scoping Criteria

A system or structure is within the scope of license renewal if it performs a safety function during and following a design basis event as defined in 10 CFR 50.54(a)(1). Design basis events are defined in 10 CFR 50.49(b)(1) 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 14 of the CNS USAR and events described in other parts of the licensing basis documentation, such as floods, fires, tornados, seismic events, and high energy line breaks.

CNS USAR Section I-2.0 defines design basis events as follows:

> Conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to function to ensure
>
> (1) the integrity of the reactor coolant pressure boundary;
>
> (2) the capability to shut down the reactor and maintain it in a safe shutdown condition; or
>
> (3) the capability to prevent or mitigate the consequences of accidents that could result in potential off-site exposures comparable to the guidelines of 10CFR100, or 10CFR50.67 (Fuel Handling Accident).

The USAR Section I-2.0 definition of safety-related states that safety-related functions, structures, systems, and components are those that are necessary to ensure the three items above.

The CNS definition does not refer to the exposure guidelines of Section 50.34(a)(1). Section 50.34(a)(1) reads,

> Stationary power reactor applicants for a construction permit pursuant to this part, or a design certification or combined license pursuant to part 52 of this chapter who apply on or after January 10, 1997, shall comply with paragraph (a)(1)(ii) of this section. All other applicants for a construction permit pursuant to this part or a design certification or combined license pursuant to part 52 of this chapter, shall comply with paragraph (a)(1)(i) of this section.

Section 50.34(a)(1)(ii) is not applicable as the CNS construction permit was issued before January 10, 1997. Section 50.34(a)(1)(i) refers to Part 100 and therefore imposes no additional requirements.

Section 50.67 applies to licensees who seek to revise the current accident source term used in their design basis radiological analyses. CNS has received a license amendment to apply the alternate source term to the fuel handling accident analysis in accordance with 10 CFR 50.67.

Therefore, the CNS definition of safety-related is consistent with the definition of safety-related SSC in 10 CFR 54.4(a)(1) and with the definition of design basis events in 10 CFR 50.49(b)(1).

CNS uses the term “essential” rather than “safety-related” in the component database. USAR Section I-2.0 defines “essential” as equivalent to “safety-related.” The two terms are used interchangeably in this application.

Mechanical systems that rely on mechanical components to perform a safety function are included in the scope of license renewal. Mechanical system codes whose only safety-related components are EIC components or structural components are not included in scope for this criterion; however, the EIC portions of the system are included in scope by default, and structural components are included in the structural evaluations.

For scoping, structural safety functions are those functions meeting the criterion of 10 CFR 54.4(a)(1) that are performed by a building. Structural safety functions include providing containment or isolation to mitigate post-accident off-site doses and providing support or protection to safety-related equipment. Structural safety functions were identified by reviewing the USAR, the Fire Hazards Analysis, design criteria documents, structural drawings, and the maintenance rule basis document for buildings. Structures that perform a safety function are within the scope of license renewal on the basis of criterion 10 CFR 54.4(a)(1).

2.1.1.2 Application of Criterion for Nonsafety-Related SSCs Whose Failure Could Prevent the Accomplishment of Safety Functions

This review identified nonsafety-related systems and structures containing components whose failure could prevent satisfactory accomplishment of a safety function. The method used was consistent with the preventive option described in Appendix F of NEI 95-10 (Reference 2.1-6). Consideration of hypothetical failures that could result from system 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 physical. A functional failure is one where the failure of a nonsafety-related SSC to perform its function impacts a safety function. A physical failure is one where a safety function is impacted by the loss of structural or mechanical integrity of a nonsafety-related SSC.

2.1.1.2.1 Functional Failures of Nonsafety-Related SSCs

Where nonsafety-related equipment is required to remain functional to support a safety function (e.g., systems with components in the main steam isolation valve (MSIV) leakage pathway), the system containing the equipment has been included in scope, and the function is listed as an intended function for 10 CFR 54.4(a)(2) for the system.

2.1.1.2.2 Physical Failures of Nonsafety-Related SSCs

Some nonsafety-related components could affect safety-related components due to their physical proximity; that is, their physical location can result in interaction between the components should the nonsafety-related component fail. Based on the license renewal rule and the guidance in NEI 95-10 (Reference 2.1-6), physical failures of nonsafety-related SSCs in scope based on 10 CFR 54.4(a)(2) fit into the following two categories.

(1) Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs

At CNS, certain components and piping outside the safety class pressure boundary must be structurally sound in order to maintain the pressure boundary integrity of safety class piping. Systems containing such nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems) are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2), as are buildings containing structural supports for the connected piping.

(2) Nonsafety-related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs

Spatial interactions can occur as (1) physical impact or flooding; (2) pipe whip, jet impingement, or harsh environments (such as caused by a high energy line break (HELB)); or (3) spray or leakage.

Physical Impact or Flooding

This category concerns potential spatial interaction of nonsafety-related SSCs falling on or otherwise physically impacting safety-related SSCs (e.g., by causing flooding) such that safety functions may not be accomplished.

Overhead handling systems whose failure could result in damage to a system that could prevent the accomplishment of a safety function are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2).

Many structural components serve as mitigating features for potential spatial interactions. Mitigating features include missile barriers, flood barriers (such as walls, curbs, dikes, and doors), and nonsafety-related supports for non-seismic (including seismic II/I) piping systems and electrical conduit and cable trays with potential for spatial interaction with safety-related equipment. The structure intended function, “Provide shelter and protection for safety-related equipment,” can encompass such structural component intended functions as missile barriers and flood barriers. Structures containing these components are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2).

Pipe Whip, Jet Impingement, or Harsh Environments

Nonsafety-related portions of high-energy lines were evaluated against the criterion of 10 CFR 54.4(a)(2). Documents reviewed included the USAR and other relevant site documentation, including the DCDs. High-energy systems were evaluated to ensure identification of components that are part of nonsafety-related high-energy lines that can affect safety-related equipment.

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 subject to aging management review in order to provide reasonable assurance that those assumptions remain valid through the period of extended operation.

Spray or Leakage

Moderate- and low-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 in the scope of license renewal and subject to aging management review.

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 components 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 aging effects for these components when the environment is a dry gas. A system containing only air or gas is not in the scope of license renewal based on the potential for spray or leakage.

The review utilized a spaces approach for scoping of nonsafety-related systems with potential spatial interaction with safety-related SSCs. The spaces approach focuses on the interaction between nonsafety-related and safety-related SSCs that are located in the same space. 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, is limited to the space.

Nonsafety-related systems that contain water, oil, or steam with components located inside structures containing safety-related SSCs are potentially in scope for possible spatial interaction under criterion 10 CFR 54.4(a)(2). These systems were evaluated further to determine if system components were located in a space such that safety-related equipment could be affected by a component failure.

Structures that are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(1) because they provide support and protection to safety-related equipment are considered to meet the criterion of 10 CFR 54.4(a)(2) also.

2.1.1.3 Application of Criterion for Regulated Events

The scope of license renewal includes those 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). This section discusses the approach used to identify the systems and structures within the scope of license renewal based on this criterion. The systems and structures that perform intended functions in support of these regulated events are identified in the descriptions in Sections 2.3, 2.4, and 2.5.

2.1.1.3.1 Commission's Regulations for 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. 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, CNS fire protection documents were reviewed. The CNS fire protection program has been developed to satisfy the requirements of Branch Technical Position (BTP) APCSB 9.5-1, Appendix A; 10 CFR 50 Appendix A, Criterion 3; 10 CFR 50.48; and 10 CFR 50, Appendix R. The documents detailing compliance with the subject requirements and forming the basis of the fire protection program are as follows:

- CNS Fire Protection Plan,
- CNS Fire Hazards Analysis, and
- 10 CFR 50 Appendix R Post-Fire Safe and Alternative Shutdown Analysis Report.

Structures required to provide support, shelter or protection to equipment meeting the criterion of 10 CFR 54.4(a)(3) based on the requirements of 10 CFR 50.48 are considered to be within the scope of license renewal based on 10 CFR 54.4(a)(3).

2.1.1.3.2 Commission's Regulations for Environmental Qualification (10 CFR 50.49)

Regulation 10 CFR 50.49 defines electric equipment important to safety that is required to be environmentally qualified to mitigate certain accidents that result in harsh environmental conditions in the plant. The Environmental Qualification (EQ) Program identifies the organizations, responsibilities, interfaces, procedures and controls necessary to implement the EQ Program to ensure compliance with 10 CFR 50.49 requirements.

As described in Section 2.1.1 of this application, a bounding scoping approach is used for EIC equipment. EIC systems and EIC equipment in mechanical systems are by default included in scope for license renewal. This includes equipment relied upon to perform a function that demonstrates compliance with the Commission’s regulations for environmental qualification.

2.1.1.3.3 Commission's Regulations for Pressurized Thermal Shock (10 CFR 50.61)

The PTS rule, 10 CFR 50.61, “Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events,” 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, CNS is not subject to this regulation.

2.1.1.3.4 Commission's Regulations for 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 system to shut down the reactor. The ATWS rule, 10 CFR 50.62, requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the probability of failure to shut down the reactor following anticipated transients and to mitigate the consequences of an ATWS event.

Based on CNS current licensing bases for ATWS, mechanical system intended functions performed in support of 10 CFR 50.62 requirements were determined (performed by the standby liquid control [SLC] and control rod drive systems). Structures containing equipment credited for ATWS are considered to be within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3) for 10 CFR 50.62.

As discussed in Section 2.1.1, a bounding approach to scoping is used for EIC equipment. EIC systems and EIC equipment in mechanical systems are by default included in scope for license renewal. Consequently, EIC equipment that supports the requirements of 10 CFR 50.62 (alternate rod injection, SLC actuation, and reactor coolant recirculating pump trip) is included in the scope of license renewal.

2.1.1.3.5 Commission's Regulations for Station Blackout (10 CFR 50.63)

10 CFR 50.63, "Loss of All Alternating Current Power," requires that each light-water-cooled nuclear power plant be able to withstand for a specified duration and recover from a station blackout (SBO). As defined by 10 CFR 50.2, a station blackout is the loss of offsite power and unavailability of the on-site emergency alternating current (AC) electric power to the essential and non-essential 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, nor does it assume a concurrent single failure or design basis accident. The objective of this requirement is to assure that nuclear power plants are capable of withstanding an SBO and maintaining adequate reactor core cooling and appropriate containment integrity for a required duration.

CNS has developed a four-hour coping analysis to address the requirements of 10 CFR 50.63. Based on the current licensing bases for SBO, system intended functions performed in support of 10 CFR 50.63 requirements were determined.

Based on NRC guidance in NUREG-1800, Section 2.5.2.1.1, certain switchyard components required to restore offsite power are conservatively included within the scope of license renewal even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout. Structures that provide support, shelter, or protection for these components are considered within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3) for 10 CFR 50.63.

As described in Section 2.1.1, a bounding approach to scoping is used for EIC equipment. On-site EIC systems and EIC equipment in mechanical systems are by default included in scope for license renewal. Consequently, EIC equipment that supports the requirements of 10 CFR 50.63 is included in the scope of license renewal.

2.1.2 Screening Methodology

Screening is the process for determining which components and structural elements require aging management review. Screening is governed by 10 CFR 54.21(a), which reads as follows.

> (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.

NEI 95-10 (Reference 2.1-6) 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 CNS followed the recommendations of NEI 95-10.

Within the group of systems and structures that are in scope, passive long-lived components or structural elements that perform intended functions require aging management review. Components or structural elements that are either active or subject to replacement based on a qualified life do not require aging management review.

Although the requirements for the integrated plant assessment are the same for each system and structure, in practice the screening process differed for mechanical systems, electrical systems, and structures. The three separate screening processes are described below.

2.1.2.1 Screening of Mechanical Systems

As required by 10 CFR 54.21(a), the screening process identified those components that are subject to aging management review for each mechanical system within the scope of license renewal. Section 2.3 presents the results for mechanical systems. Mechanical component intended functions are included in Table 2.0-1.

2.1.2.1.1 Identifying Components Subject to Aging Management Review

Within the system, components are subject to aging management review if they perform an intended function without moving parts or a change in configuration or properties and if they are not subject to replacement based on a qualified life or specified time period.

In making the determination that a component performs an intended function without moving parts or a change in configuration or properties, it is not necessary to consider the piece parts of the component. However, in the case of valves, pumps, and housings for fans and dampers, the valve bodies, pump casings, and housings may perform an intended function by maintaining the pressure boundary and may therefore be subject to aging management review.

Replacement programs are based on vendor recommendations, plant experience, or any means that establishes a specific service life, qualified life, or replacement frequency under a controlled program. Components that are subject to replacement based on qualified life or specified time period are not subject to aging management review. Where flexible elastomer hoses/expansion joints or other components are periodically replaced, these components are not subject to aging management review.

Safety-related instrument air solenoid valves that open to relieve pressure and fail to a safe position upon loss of pressure boundary do not require aging management review because maintaining a pressure boundary is not a component intended function for these valves.

2.1.2.1.2 Identifying Components Subject to Aging Management Review Based on Support of an Intended Function for 10 CFR 54.4(a)(2)

As discussed in Section 2.1.1.2, systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) interact with safety-related systems in one of two ways: functional or physical. A functional failure is one where the failure of a nonsafety-related SSC to perform its function impacts a safety function. A physical failure is one where a safety function is impacted by the loss of structural or mechanical integrity of an SSC.

As discussed in Section 2.1.1.2, physical failures of nonsafety-related systems in scope based on 10 CFR 54.4(a)(2) fit into the following two categories:

- nonsafety-related systems or components directly connected to safety-related systems (typically piping systems); or
- nonsafety-related systems or components with the potential for spatial interaction with safety-related SSCs.

Appropriate LRA drawings for the systems were reviewed to identify safety-to-nonsafety interfaces. Nonsafety-related components connected to safety-related components were included to the first seismic anchor or base-mounted component. A seismic anchor is defined as hardware or structures that, as required by the analysis, physically restrain forces and moments in three orthogonal directions. Scope was typically determined by the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a base-mounted component, flexible connection, or the end of a piping run (such as a vent or drain line). Also, piping isometrics were used to identify seismic anchors when required to establish scope boundary. This is consistent with the guidance in NEI 95-10, Appendix F.

The following modes of spatial interaction, described in Section 2.1.1.2, were considered in the screening process.

Physical Impact or Flooding

Nonsafety-related supports for non-seismic (including seismic II/I) piping systems and electrical conduit and cable trays with potential for spatial interaction with safety-related structures or components (SCs) are subject to aging management review based on the criteria of 10 CFR 54.4(a)(2) and 54.21(a). These supports and components are addressed in a commodity fashion with the structural evaluations in Section 2.4.

Reviews of earthquake experience identified no occurrences of welded steel pipe segments falling due to a strong motion earthquake. Falling of piping segments is extremely rare and only occurs when there is a failure of the supports. This conclusion applies for new and aged pipe. Therefore, as long as the effects of aging on the supports for piping systems are managed, falling of piping sections is not credible except due to flow accelerated corrosion, and the piping section itself is not in scope for 10 CFR 54.4(a)(2) due to a physical impact hazard (but may be in scope due to the potential for leakage or spray). (Reference 2.1-6)

Missiles can be generated from internal or external events such as failure of rotating equipment. Nonsafety-related design features that protect safety-related equipment from missiles are subject to aging management review based on the criteria of 10 CFR 54.4(a)(2) and 54.21(a). These features are addressed with the structural evaluations in Section 2.4.

The overhead-handling systems (e.g., cranes) whose failure could result in damage to a system that could prevent the accomplishment of a safety function are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2). Specific components in these systems are subject to aging management review. These features are addressed with the structural evaluations for the structure in which the components are located.

Walls, curbs, dikes, doors, etc., that provide flood barriers to safety-related equipment are subject to aging management review based on the criteria of 10 CFR 54.4(a)(2) and 54.21(a). These structural components have been included in the evaluation of the building in which they are located or in the evaluation of structural bulk commodities.

Structures and structural components are reviewed in Section 2.4.

Pipe Whip, Jet Impingement, or Harsh Environments

In order to ensure the nonsafety-related portions of high-energy lines were included in the 10 CFR 54.4(a)(2) review, the CNS USAR and associated site documentation was reviewed. (See USAR Section IV-12.)

Many of these high-energy lines are safety-related components in systems that are already within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(1). During review of the CNS systems for 10 CFR 54.4(a)(2), high energy systems were considered. If a 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). Appropriate components are subject to aging management review in order to provide reasonable assurance that those analysis assumptions remain valid through the period of extended operation.

Components in these high-energy lines are included in the appropriate system table for the 10 CFR 54.4(a)(2) review (Sections 2.3.2.8, 2.3.3.14, and 2.3.4.2).

Leakage or Spray

For nonsafety-related systems with the potential for spatial interaction with safety-related components, a spaces approach was used to identify components subject to aging management review. Components containing oil, steam or liquid and located in spaces containing safety-related equipment were subject to aging management review.

The following structures (and therefore spaces within them) contain safety-related components.

- control building
- diesel generator rooms
- drywell (includes the suppression chamber)
- elevated release point
- intake structure (service water pump rooms only)
- off-gas building
- reactor building (except the railroad airlock)
- turbine building (except the basement)

2.1.2.1.3 Mechanical System Drawings

License renewal drawings were prepared to indicate portions of systems that support system intended functions within the scope of license renewal. Components subject to aging management review (i.e., passive, long-lived components that support system intended functions) are highlighted using color coding to indicate which aging management review evaluated the components.

Flexible elastomer hoses/expansion joints and other components that are periodically replaced and therefore not subject to aging management review are indicated as such on the drawings. Safety-related instrument air solenoid valves that open to relieve pressure and fail to a safe position upon loss of pressure boundary do not require aging management review and thus are not highlighted.

2.1.2.2 Screening of Structures

For each structure within the scope of license renewal, the structural components and commodities were evaluated to determine those subject to aging management review. This evaluation (screening process) for structural components and commodities involved a review of design basis documents, design drawings, general arrangement drawings, penetration drawings, and the USAR to identify specific structural components and commodities that make up the structure. Structural components and commodities subject to aging management review are those that (1) perform an intended function without moving parts or a change in configuration or properties, and (2) are not subject to replacement based on qualified life or specified time period. Section 2.4 presents the results for structures.

2.1.2.2.1 Structural Component and Commodity Groups

Structural components and commodities often have no unique identifiers such as those given to mechanical components. Therefore, grouping structural components and commodities based on materials of construction provided a practical means of categorizing them for aging management reviews. Structural components and commodities were categorized by the following groups based on materials of construction.

- steel and other metals
- bolted connections
- concrete
- other materials (e.g., fire barrier material, elastomers, wood)

2.1.2.2.2 Evaluation Boundaries

Structural evaluation boundaries were established as described below.

ASME and Non-ASME Component Supports—Mechanical Components

The evaluation boundaries for mechanical component supports were established in accordance with rules governing inspection of component supports (i.e., American Society of Mechanical Engineers (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 Supports—Electrical Components

Supports for electrical components include cable trays, conduits, electrical panels, racks, cabinets and other enclosures. The evaluation boundary for these items includes supporting elements, including integral attachments to the building structure.

Other Structural Members

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

2.1.2.2.3 Intended Functions

Structural components and commodities were evaluated to determine intended functions as they relate to license renewal. NEI 95-10 (Reference 2.1-6) provides guidelines for determining the intended functions of structures, structural components and commodities.

Structural component and commodity intended functions include providing shelter or protection and providing structural or functional support. Many structural components either have the potential for spatial interaction with safety-related equipment (e.g., cranes, hoists) or serve as mitigating features for potential spatial interactions. Mitigating features include missile barriers, flood barriers, HELB protection, and nonsafety-related supports for non-seismic (including seismic II/I) piping systems and electrical conduit and cable trays with potential for spatial interaction with safety-related equipment.

Structural component intended functions are included in Table 2.0-1.

2.1.2.3 Electrical and Instrumentation and Control Systems

The EIC aging management review evaluates commodity groups containing components with similar characteristics. Screening applied to commodity groups determines which EIC components are subject to aging management review. An aging management review is required for commodity groups that perform an intended function, as described in 10 CFR 54.4, without moving parts or without a change in configuration or properties (passive) and that are not subject to replacement based on a qualified life or specified time period (long-lived). Section 2.5 presents the results for electrical systems. Electrical component intended functions are included in Table 2.0-1.

2.1.2.3.1 Passive Screening

NEI 95-10, Appendix B, "Typical Structure, Component and Commodity Groupings and Active/ Passive Determinations for the Integrated Plant Assessment," identifies electrical commodities considered to be passive. CNS electrical commodity groups correspond to two of the NEI 95-10 passive EIC commodity groups. These are the electrical commodity groups that meet the 10 CFR 54.21(a)(1)(i) criterion (i.e., components that perform an intended function without moving parts or without a change in configuration):

- high voltage insulators, and
- cables and connections, bus, electrical portions of EIC penetration assemblies, fuse holders outside of cabinets of active electrical components.

The commodity group "cables and connections, bus, electrical portions of EIC penetration assemblies, fuse holders outside of cabinets of active electrical components" is subdivided as shown in Table 2.5-1. Other CNS EIC commodity groups are active and do not require aging management review.

EIC components whose primary function is electrical can also have a mechanical pressure boundary function. These components are elements, resistance temperature detectors, sensors, thermocouples, transducers, solenoid valves, and heaters. According to Appendix B of NEI 95-10, the electrical portions of these components are active per 10 CFR 54.21(a)(1)(i) and are therefore not subject to aging management review. Only the pressure boundary of such an in-scope component is subject to aging management review, and the pressure boundary function for these EIC components is addressed in the mechanical review.

Electrical components are supported by structural commodities (e.g., cable trays, electrical penetrations, conduit, or cable trenches), which are included in the structural aging management reviews.

2.1.2.3.2 Long-Lived Screening

Electrical components and EIC penetration assemblies included in the environmental qualification (EQ) program per 10 CFR 50.49 are subject to replacement based on their qualified life. Therefore, in accordance with 10 CFR 54.21(a)(1)(ii), EQ components are not subject to aging management review. EQ components are covered by analyses or calculations that may be time-limited aging analyses (TLAAs), as defined in 10 CFR 54.3.

2.1.2.4 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. 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.

2.1.2.4.1 Packing, Gaskets, Component Seals, and O-Rings

Packing, gaskets, component mechanical seals, and O-rings are typically used to provide a leak-proof seal when components are mechanically joined together. These items are commonly found in components such as valves, pumps, heat exchangers, ventilation units or ducts, and piping segments.

In accordance with American National Standards Institute (ANSI) B31.1 and the ASME Boiler and Pressure Vessel (B&PV) Code Section III, the subcomponents of pressure retaining components as shown above are not considered pressure-retaining parts. Therefore, these subcomponents are not relied on to perform a license renewal intended function and are not subject to aging management review.

2.1.2.4.2 Structural Sealants

Elastomers and other materials used as structural sealants are subject to aging management review if they are not periodically replaced and they perform an intended function, typically supporting a pressure boundary, flood barrier, or rated fire barrier.

Seals and sealants are considered in the aging management review of bulk commodities (Section 2.4.4).

2.1.2.4.3 Oil, Grease, and Filters

Oil, grease, and component filters have been treated as consumables because either (1) they are periodically replaced or (2) they are monitored and replaced based on condition.

2.1.2.4.4 System Filters, Fire Extinguishers, Fire Hoses, and Air Packs

Components such as system filters, fire hoses, fire extinguishers, self-contained breathing apparatus (SCBA), and SCBA cylinders are considered to be consumables and are routinely tested, inspected, and replaced when necessary. Fire protection at CNS complies with the applicable safety standards (e.g., BTP-APCSB 9.5.1, National Fire Protection Association document NFPA-10-1975 for fire extinguishers, NFPA-1962 for fire hoses, NFPA Standard-1981 for SCBA Air cylinders, 29 CFR 1910.134 for respiratory protection), which specify performance and condition monitoring programs for these specific components. Fire hoses and fire extinguishers are inspected and hydrostatically tested periodically and must be replaced if they do not pass the test or inspection. SCBA and SCBA cylinders are inspected and periodically tested 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. Therefore, while these consumables are in 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 2.1-6), the NRC has encouraged applicants for license renewal to address proposed interim staff guidance (ISGs) in the LRA. Most past ISGs were resolved (References 2.1-8, 2.1-9) with the issuance of Revision 1 of the license renewal guidance documents NUREG-1800 (Reference 2.1-2), NUREG-1801 (Reference 2.1-3), and RG 1.188 (Reference 2.1-4) and Revision 6 of NEI 95-10. LR-ISG-23 was determined to be unnecessary and closed since adequate guidance already exists (Reference 2.1-10). Remaining ISGs are addressed as follows.

LR-ISG-19B	Proposed Aging Management Program XI.M11-B, "Nickel-alloy Base-metal Components and Welds in the Reactor Coolant Pressure Boundary," for License Renewal
LR-ISG-2006-01	Corrosion of the Mark I Steel Containment Drywell Shell
LR-ISG-2006-02	Proposed Staff Guidance on Acceptance Review for Environmental Requirements
LR-ISG-2006-03	Staff Guidance for Preparing Severe Accident Mitigation Alternatives (SAMA) Analyses
LR-ISG-2007-01	Update to the License Renewal Interim Staff Guidance Process
LR-ISG-2007-02	Proposed Changes to Generic Aging Lesson Learned (GALL) Report Aging Management Program (AMP) XI.E6, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
LR-ISG-2008-01	Proposed Staff Guidance Regarding the Station Blackout Rule (10 CFR 50.63) Associated with License Renewal Applications

LR-ISG-19B, "Proposed Aging Management Program XI.M11-B, 'Nickel-alloy Base-metal Components and Welds in the Reactor Coolant Pressure Boundary,' for License Renewal," is applicable only to PWRs.

LR-ISG-2007-01 will update the LR-ISG process to include references to the environmental review guidance documents, references for the recent publication of Revision 1 of the license renewal guidance documents, and minor revisions to be consistent with current staff practices. This ISG is still in development.

The remaining ISGs are discussed below.

LR-ISG-2006-01 Corrosion of the Mark I Steel Containment Drywell Shell

The CNS drywell steel shell and the moisture barrier where the drywell shell becomes embedded in the drywell concrete floor are inspected in accordance with the Containment Inservice Inspection (CII) IWE Program and Structures Monitoring Program. The exterior surface of the drywell shell at the sand cushion is effectively drained and protected from condensation or water that might enter the air gap from above and potentially cause corrosion. Therefore, significant corrosion of the CNS drywell is not expected. See Table 3.5.1, Item 3.5.1-5.

LR-ISG-2006-02 Proposed Staff Guidance on Acceptance Review for Environmental Requirements

LR-ISG-2006-02 was issued in draft form by the NRC on February 8, 2007. A review of the draft ISG determined that the environmental report has met the guidance of LR-ISG-2006-02. Environmental report preparation was in accordance with guidance of Supplement 1 to Regulatory Guide 4.2, “Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses.”

LR-ISG-2006-03 Staff Guidance for Preparing Severe Accident Mitigation Alternatives (SAMA) Analyses

This ISG recommends that applicants for license renewal use guidance document NEI 05-01, Rev. A (Reference 2.1-7) when preparing SAMA analyses. The CNS SAMA analysis provided as a part of Appendix E is consistent with the guidance of NEI 05-01 as discussed in this ISG.

LR-ISG-2007-02 Changes to Generic Aging Lesson Learned (GALL) Report Aging Management Program (AMP) XI.E6, “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”

This ISG recommends a one-time inspection prior to the period of extended operation for electrical cable connections not subject to 10 CFR 50.49 EQ requirements. CNS will implement a one-time inspection program prior to the period of extended operation to confirm the absence of aging effects for applicable electrical cable connections.

LR-ISG-2008-01 Staff Guidance Regarding the Station Blackout Rule (10 CFR 50.63) Associated with License Renewal Applications

LR-ISG-2008-01 was issued in draft form by the NRC on March 5, 2008. This ISG recommends inclusion of the SBO offsite power recovery path from the transmission system breakers to the plant's Class 1E distribution system in the scope of license renewal. CNS considered the recommendations of the draft ISG in the determination of the offsite power recovery path for license renewal scope.

2.1.4 Generic Safety Issues

In accordance with the guidance in NEI 95-10, 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 that involve an issue related to the license renewal aging management review or time-limited aging analysis evaluations are to be addressed in the LRA. Based on NUREG-0933 (Reference 2.1-5), the following GSI is addressed in this application.

GSI-156.6.1 Pipe Break Effects on Systems and Components

GSI-156.6.1 addresses postulated high-energy line breaks inside containment in which the effects of the resulting pipe break prevent the operation of systems required to mitigate the effects of the break. The GSI is related to aging of piping systems, because the probability of failure of a piping system is affected by degradation, including metal fatigue, that occurs over time. Age-related piping degradation for high-energy piping is addressed in the aging management review for mechanical systems in Section 3 and in the TLAA evaluations of piping components in Section 4.

Based on the above, the GSI review determined that the issues involving either aging effects for SCs subject to an aging management review or TLAAs are addressed in the license renewal application.

2.1.5 Conclusion

The methods described in Sections 2.1.1 and 2.1.2 were used at CNS 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).

2.1.6 References

2.1-1 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

2.1-2 U.S. Nuclear Regulatory Commission, NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, September 2005.

2.1-3 U.S. Nuclear Regulatory Commission, NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Volume 1 and Volume 2, September 2005.

2.1-4 U.S. Nuclear Regulatory Commission, Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," Revision 1, September 2005.

2.1-5 U.S. Nuclear Regulatory Commission, NUREG-0933, *A Prioritization of Generic Safety Issues*, September 2007 (Appendix B, "Applicability of NUREG-0933 Issues to Operating and Future Reactor Plants," Revision 22, June 30, 2007).

2.1-6 Nuclear Energy Institute, NEI 95-10, *Industry Guideline on Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule*, Revision 6, June 2005.

2.1-7 Nuclear Energy Institute, NEI 05-01, *Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document*, Revision A, November 2005.

2.1-8 Kuo, P. T. (NRC) to A. Marion (NEI) and D. Lochbaum (Union of Concerned Scientists), "Status of Interim Staff Guidance Associated with License Renewal," letter dated May 19, 2005.

2.1-9 Kuo, P. T. (NRC) to A. Marion (NEI) and D. Lochbaum (Union of Concerned Scientists), "Staff Resolution Associated with Interim Staff Guidance ISG-07 Proposed Staff Guidance on the Scoping of Fire Protection Equipment for License Renewal," letter dated June 7, 2005.

2.1-10 Kuo, P. T. (NRC) to A. Marion (NEI) and D. Lachbaum (Union of Concerned Scientists), "Staff Resolution Associated with License Renewal Interim Staff Guidance LR-ISG-23: Replacement Parts Necessary to Meet 10 CFR 50.48 (Fire Protection)," letter dated December 20, 2006.

2.2 PLANT LEVEL SCOPING RESULTS

Tables 2.2-1-A, 2.2-1-B, and 2.2-3 list the mechanical systems, EIC systems, and structures, respectively, that are within the scope of license renewal for CNS. For mechanical systems, a reference is given to the section which describes the system. For electrical systems, no description is necessary since plant electrical systems are in scope by default (see Section 2.5), but a USAR reference is provided where applicable. For structures, a reference is given to the section that includes the structure in the evaluation.

Tables 2.2-2 and 2.2-4 list the systems and structures, respectively, 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 Updated Safety Analysis Report (USAR) that describes the system or structure. For structures with no description in the USAR, a brief description of the building function is given. None of these structures house safety-related equipment.

The list of systems used in these tables and determination of system boundaries is based on the CNS equipment database. The equipment database is a controlled list of plant systems and components, with each component assigned to one plant system. System intended functions are identified in the section referenced in Table 2.2-1-A. As needed, system components are grouped functionally for the aging management review. For example, ASME Class 1 components in various systems (e.g., the standby liquid control system) are evaluated with the ASME Class 1 reactor coolant system in Section 2.3.1.3, and primary containment penetrations from various systems are grouped into one primary containment penetrations review in Section 2.3.2.7. For each system, see the discussion under "Components Subject to Aging Management Review" for further information.

Nonsafety-related components whose failure could prevent satisfactory accomplishment of safety functions (10 CFR 54.4(a)(2)) due to the potential for a physical interaction (see Section 2.1.1.2) are evaluated together in the (a)(2) aging management reviews (AMRs). The (a)(2) AMRs include nonsafety-related components with the potential for a spatial interaction with a safety-related system as well as components in safety-related systems outside the safety class pressure boundary, such as piping, valves, pumps, and support elements, that are required to be structurally sound in order to maintain the integrity of safety class piping. The (a)(2) reviews are presented at the end of the mechanical system sections (Section 2.3.2.8, ESF Systems in Scope for 10 CFR 54.4(a)(2); Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2); and Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)).

The list of plant structures was developed from a review of the USAR, site drawings, Fire Hazards Analysis, design criteria documents, and maintenance rule basis document. Structure intended functions are identified in the section referenced in Table 2.2-3. Structural commodities associated with mechanical systems, such as pipe supports and insulation, are evaluated with the structural bulk commodities.

Components subject to aging management review are highlighted on license renewal drawings. A list of drawings is provided for each aging management review. For further discussion of license renewal drawings, see Section 2.1.2.1.3.

Because of the bounding approach used for scoping EIC equipment, all plant EIC commodities contained in electrical and mechanical systems are in scope by default. Descriptions of each electrical system are not provided. In addition to plant electrical systems, certain switchyard components in the offsite power systems are in scope for support of offsite power recovery following a station blackout (SBO).

EIC system codes that also have mechanical components that meet the scoping criteria of 10 CFR 54.4 are listed in Table 2.2-1-A, which results in some system codes being listed both in Table 2.2-1-A and Table 2.2-1-B.

For further information, see Section 2.5, Scoping and Screening Results: Electrical and Instrumentation and Control Systems.

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

System Name (System Code)	LRA Section Describing System
Air Removal (AR)	Section 2.3.3.12, Plant Drains
Auxiliary Condensate Drains (ACD)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Auxiliary Steam (AS)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Carbon Dioxide (CO_2)	Section 2.3.3.7, Halon and CO_2
Circulating Water (CW)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Condensate Drain (CD)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Condensate Filter Demineralizer (CF)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Condensate Makeup (CM)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Control Rod Drive (CRD)	Section 2.3.3.2, Control Rod Drive
Core Spray (CS)	Section 2.3.2.2, Core Spray
Demineralized Water (DW)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Diesel Generator (DG)	Section 2.3.3.4, Diesel Generator
Diesel Generator Fuel Oil (DGDO)	Section 2.3.3.5, Fuel Oil
Diesel Generator Jacket Water (DGJW)	Section 2.3.3.4, Diesel Generator
Diesel Generator Lube Oil (DGLO)	Section 2.3.3.4, Diesel Generator
Diesel Generator Starting Air (DGSA)	Section 2.3.3.4, Diesel Generator
Extraction Steam (ES)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Fire Protection (FP)	Section 2.3.3.6, Fire Protection – Water Section 2.3.3.7, Halon and CO2

Table 2.2-1-A
Mechanical Systems within the Scope of License Renewal (Continued)

System Name (System Code)	LRA Section Describing System
Floor Drains, Non-Radioactive (FDN)	Section 2.3.3.12, Plant Drains
Fuel Pool Cooling and Cleanup (FPC)	Section 2.3.3.9, Fuel Pool Cooling and Cleanup
Heating and Ventilation (HV)	Section 2.3.3.8, Heating, Ventilation and Air Conditioning
High Pressure Coolant Injection (HPCI)	Section 2.3.2.4, High Pressure Coolant Injection
Instrument Air (IA)	Section 2.3.3.10, Instrument Air
Main Condensate (MC)	Section 2.3.4.1, MSIV Leakage Pathway
Main Steam (MS)	Section 2.3.4.1, MSIV Leakage Pathway
Neutron Monitoring (NM)	Section 2.3.2.7, Primary Containment
Neutron Monitoring—Traversing Incore Probe (NMT)	Section 2.3.2.7, Primary Containment
Nitrogen (N2)	Section 2.3.3.13, Nitrogen
Nuclear Boiler (NB)	Section 2.3.1, Reactor Coolant System
Nuclear Boiler Instrumentation (NBI)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Off Gas (OG)	Section 2.3.3.12, Plant Drains
Optimum Water Chemistry (OWC)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Post-Accident Sample (PAS)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Potable Water (PW)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Primary Containment (PC)	Section 2.3.2.7, Primary Containment
Radiation Monitoring—Process (RMP)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

Table 2.2-1-A
Mechanical Systems within the Scope of License Renewal (Continued)

System Name (System Code)	LRA Section Describing System
Radiation Monitoring—Vent (RMV)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Radwaste (RW)	Section 2.3.3.12, Plant Drains
Reactor Core Isolation Cooling (RCIC)	Section 2.3.2.5, Reactor Core Isolation Cooling
Reactor Equipment Cooling (REC)	Section 2.3.3.11, Reactor Equipment Cooling
Reactor Feedwater (RF)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Reactor Feedwater Pump and Turbine Lube Oil (RFLO)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Reactor Recirculation (RR)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Reactor Recirculation—Lube Oil (RRLO)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Reactor Water Cleanup (RWCU)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Residual Heat Removal (RHR)	Section 2.3.2.1, Residual Heat Removal
Service Air (SA)	Section 2.3.3.10, Instrument Air
Service Water (SW)	Section 2.3.3.3, Service Water
Standby Gas Treatment (SGT)	Section 2.3.2.6, Standby Gas Treatment
Standby Liquid Control (SLC)	Section 2.3.3.1, Standby Liquid Control
Standby Nitrogen Injection (SBNI)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Tools and Servicing Equipment (TSE)	Section 2.3.3.9, Fuel Pool Cooling and Cleanup
Turbine Equipment Cooling (TEC)	Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
Turbine Generator (TG)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

Table 2.2-1-A
Mechanical Systems within the Scope of License Renewal (Continued)

System Name (System Code)	LRA Section Describing System
Turbine Generator Electro-Hydraulic (EH) Fluid (TGF)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Turbine Generator Lube Oil—Mech (LO)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
Turbine Lube Oil—Instruments (LOGT)	Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

Table 2.2-1-B
Plant EIC Systems
within the Scope of License Renewal

System Name (System Code)	USAR Reference
Annunciator (ANN)	Section VII-1.7.3.6
Cathodic Protection (CP)	None
Computer Process Equipment (CPE)	Section VII-16.0
Electrical Equipment (EE) (system code includes the following subgroups)	
22 kVAC Electrical	Section VIII-2.1.3
12.5 kVAC Electrical	Section VIII-9.0
4.16 kVAC Electrical	Section VIII-3.5 and 4.5
480 VAC Electrical	Section VIII-4.5.1
460 VAC Electrical	Section VIII-4.5.2 and 6.0
240 VAC Electrical	Section VIII-8.0
120 VAC Electrical	Section VIII-8.0
250 VDC Electrical	Section VIII-6.0
125 VDC Electrical	Section VIII-6.0
24 VDC Electrical	Section VIII-7.0
115/230 VAC No-Break Power System	Section VIII-1.0, 6.3, and 8.3
Generator Seal Oil—Instruments (LOGS)	Section VII-11.5.1
Health Physics Instrumentation (HPI)	Section VII-15.0
Inter Communication (IC)	Section X-16.0
Meteorological Instruments (MI)	Section II-3.3
Nuclear Boiler Instrumentation (NBI)	Section VII-8.0
Neutron Monitoring (NM)	Section VII-5.0
Neutron Monitoring—Flow Unit (NMF)	Section VII-5.0
Neutron Monitoring—Intermediate Range Monitors (NMI)	Section VII-5.0
Neutron Monitoring—Source Range Monitors (NMS)	Section VII-5.0
Neutron Monitoring—Traversing Incore Probe (NMT)	Section VII-5.0
Plant Management Information System (PMIS)	Section VII-16.0
Primary Containment Isolation (PCIS)	Section VII-3.0

Table 2.2-1-B
Plant EIC Systems
within the Scope of License Renewal (Continued)

System Name (System Code)	USAR Reference
Radiation Monitoring—Area (RMA)	Section VII-13.0 and 14.0
Radiation Monitoring—Process (RMP)	Section VII-12.0
Reactor Feedwater Control (RFC)	Section VII-10.0
Reactor Manual Control (RMC)	Section VII-7.0
Reactor Protection (RPS)	Section VII-2.0
Reactor Recirculation—Flow Control (RRFC)	Section VII-9.0
Reactor Recirculation—Motor-Generator Set (RRMG)	Section VII-9.5.2, 9.5.3
Rod Position Information (RPIS)	Section VII-7.5.3.2 and 7.5.4
Site Security (SS)	None
Turbine Generator EH Control (TGC)	Section VII-11.0
Turbine Generator Supervisory Instruments (TGI)	Section VII-11.5.1
Turbine Lube Oil—Instruments (LOGT)	Section VII-11.5.1
Off-site Power Systems[1]	
161 kVAC Electrical	Section VIII
69 kVAC Electrical	Section VIII

1. These are not plant systems but are included for completeness. There is no system code assigned to these systems.

Table 2.2-2
Mechanical Systems Not within the Scope of License Renewal

System Name (System Code)	USAR Reference
Annunciator (ANN)[1]	Section VII-1.7.3.6
Atmospheric Containment (ACAD)[2]	None
Augmented Off Gas (AOG)	Section IX-4.4
Auxiliary Condensate (AC)	Section X-10.1.1
Auxiliary Steam Boilers (ASB)	Section X-10.1.1
Building (BLDG)[3]	None
Fuel Gas (Propane) (FG)	None
Fuel Oil (FO)[4]	None
Heating Water (Office) (HW)	None
Hydrogen (H2)	Section XI-2.3
Outside Protected Area (OPA)	None
Sewage Treatment (ST)	None (mentioned in Section X-13.0 but not described)
Water Treatment (WT)	Section X-11.0

1. The ANN system consists of EIC components except for nonsafety-related air conditioners and one nonsafety-related heat exchanger.
2. ACAD system components are spare. The SBNI system performs the function for which ACAD was designed.
3. The BLDG system code includes miscellaneous mechanical components, none of which have an intended function for license renewal.
4. The FO system only contains the bulk fuel storage tanks, which have no intended functions for license renewal. The diesel generator fuel oil supply is a separate system, DGDO. Fuel oil for use by the fire protection system is included in the FP system.

Table 2.2-3
Structures within the Scope of License Renewal

Structure Name	LRA Section
Augmented Radioactive Waste Building	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Control Building	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Controlled Corridor	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Control House 161 kV Switchyard	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Cranes, Trolleys, Monorails and Hoists	Evaluated as structural components or commodities of the structure in which they are located.
Diesel Generator Building	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Elevated Release Point (ERP) Tower	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Fire Protection Water Tanks Foundation	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Fire Protection Pumphouse	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Intake Structure	Section 2.4.2, Water Control Structures
Liquid Nitrogen Tank Foundation	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Manholes and Duct Banks	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Multi-Purpose Facility	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Office Building (Administration Bldg)	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures

Table 2.2-3
Structures within the Scope of License Renewal

Structure Name	LRA Section
Off Gas Filter and Fan Building	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Oil Tank Bunker	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Primary Containment Structure	Section 2.4.1, Reactor Building and Primary Containment
Radioactive Waste Building	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Reactor Building	Section 2.4.1, Reactor Building and Primary Containment
Transformer and Switchyard Support Structures and Foundations	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Transmission Towers and Foundations	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Turbine Building (including appendages)	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures

Table 2.2-4
Structures Not within the Scope of License Renewal

Structure Name	Structure Function or USAR Reference
Boat Ramp Structure	Provides space for access to the river.
Communications Building (Emergency Operations Facility Building)	Provides space for site communication equipment.
Condensate Storage Tanks Foundation and Retaining Wall	Section XI-9.3
Control House 345 kV Switchyard	Section VIII-2.2.5
Craft Change Building	Provides a general craft and administrative area for personnel.
Discharge Structure (Seal Well)	Section XII-2.2.7
Fab Shop	Provides additional space for equipment fabrication.
Flammable Liquid Storage Building	Provides a storage area for flammable materials.
Fuel Oil Storage Tank Foundation	Supports the above-ground fuel oil tank, which has no intended functions for license renewal.
Gas Bottle Storage Building	Provides a storage location and protection for gas bottle canisters containing various gases.
Hazardous Material Storage Cabinet	Provides a storage location for hazardous materials brought on site.
Learning Center (Training Center)	Provides space and facilities for training plant and contractor personnel.
Low Level Radwaste Storage Facility Pad	Section IX-3.3.2.3.1
Maintenance Training Facility	Used for training station personnel.
Optimum Water Chemistry Gas Generator Building	Section XII-2.2.15
Security Building	Houses the central alarm station.
Sewage Treatment Control House	Contains equipment for treatment of site sewage and other waste.

Table 2.2-4
Structures Not within the Scope of License Renewal (Continued)

Structure Name	Structure Function or USAR Reference
Sludge Pond Sample Point Building	Contains equipment for sampling and testing discharge effluent (portable prefab building).
South Rad Material Storage Building	Provides storage area for low level waste.
Technical Support Building	Provides space for administrative and support personnel.
Toilet Building	Provides toilet facilities for plant and contractor personnel.
Utility Building	Provides space for site personnel and emergency service vehicles.
Warehouse (East and West)	Serve as the central point for storage of plant’s materials and replacement parts.

2.3 SCOPING AND SCREENING RESULTS: MECHANICAL SYSTEMS

2.3.1 Reactor Coolant System

System Description

The reactor coolant system (RCS) consists of components in the nuclear boiler (NB) system code and the reactor coolant pressure boundary (RCPB), which includes ASME Class 1 components in several different system codes (see Section 2.3.1.3). The reactor coolant system is described as three subsystems:

- the reactor vessel;
- the reactor vessel internals; and
- the reactor coolant pressure boundary.

Reactor Vessel

The purpose of the reactor vessel and appurtenances is to contain and support the reactor core and vessel internals and to provide a barrier to the release of radioactive materials from the core. The reactor vessel provides a volume in which the core can be submerged in coolant. The reactor vessel and appurtenances includes the vessel shell, top and bottom heads, nozzles and penetrations, internal and external attachments and vessel supports.

The reactor vessel is a vertical, cylindrical pressure vessel with hemispherical heads of welded construction. The cylindrical shell and bottom hemispherical head of the reactor vessel are fabricated of low alloy steel plate which is clad on the interior with stainless steel weld overlay. The vessel top-head is secured to the reactor vessel by studs and nuts.

Vessel nozzles connect the reactor vessel to various systems and components, including feedwater, main steam, recirculation, core spray, standby liquid control, control rod drive mechanisms, in-core flux instrumentation, vents, drains, head seal leak detection piping, and reactor level and pressure sensing lines.

There are multiple attachments to the reactor pressure vessel (RPV) for supporting various internal components. These internal attachments include guide rod brackets, steam dryer support brackets, dryer hold-down brackets, feedwater sparger brackets, jet pump riser support pads, core spray brackets, and surveillance specimen holder brackets.

There are multiple external attachments to the RPV. The external attachments include stabilizer brackets, top head lifting lugs, insulation support brackets, and thermocouple pads.

The reactor vessel is supported by a low-alloy steel skirt. The skirt is welded to the bottom of the vessel shell. The skirt rests on a ring girder support on a reinforced concrete pedestal that is integral with the primary containment foundation.

Vessel stabilizers transmit seismic and jet reaction forces from the reactor vessel to the top of the shield wall surrounding the vessel. Full penetration welds attach four stabilizer brackets to the reactor vessel at evenly spaced locations around the vessel below the flange.

Reactor Vessel Internals

The purpose of the reactor vessel internals is to properly distribute the flow of coolant delivered to the vessel, locate and support the fuel assemblies, separate moisture from the steam leaving the vessel, and provide an inner volume containing the core that can be flooded following a break in the nuclear system process barrier external to the reactor vessel.

The reactor vessel internals include the following subcomponents. In addition to the components described in USAR Section III-3.5, the guide rods and jet pump instrumentation are included.

- shroud
- shroud head and steam separator assembly
- shroud support assembly
- core support (core plate)
- top guide assembly
- fuel support pieces
- fuel support plugs
- control rod guide tubes and thermal sleeves
- jet pump assemblies
- steam dryers
- feedwater spargers
- core spray lines
- differential pressure (ΔP) and standby liquid control line
- incore flux monitor dry tubes, guide tubes, and local power range monitor (LPRM)
- initial startup neutron sources
- surveillance sample holders
- guide rods
- jet pump instrumentation

The core structure surrounds the active core of the reactor and consists of the core shroud, shroud head and steam separator assembly, core support, and top guide. This structure is used to form partitions within the reactor vessel, to sustain pressure differentials across the partitions, to direct the flow of the coolant water, and to locate laterally and support the fuel assemblies, control rod guide tubes, and steam separators.

Reactor Coolant Pressure Boundary

The RCPB is the portion of the nuclear system consisting of the reactor vessel and attached piping out to and including the second isolation valve in each attached pipe. These components have the function of maintaining the RCPB. See Section 2.3.1.3 for further details.

The reactor coolant system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide a barrier to the release of radioactive materials.
- Provide a volume in which the core can be submerged in coolant.
- Provide structural integrity for reactor vessel internals.
- Maintain reactor core geometry
  - to provide 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; and
  - to provide correct coolant distribution.
- Maintain reactor coolant pressure boundary.

The reactor coolant system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain the integrity of the steam dryer to assure no impact on safety functions of other components.

The reactor coolant system has no intended functions for 10 CFR 54.4(a)(3).

USAR References

Section III-3.0, IV-2.0, I-2.0 (definition of RCPB)

Components Subject to Aging Management Review

Fuel assemblies are not subject to aging management review as they are periodically replaced and are therefore not long lived.

CNS does not have an isolation condenser.

Components in the reactor coolant system are reviewed as listed below:

- reactor vessel (Section 2.3.1.1),
- reactor vessel internals (Section 2.3.1.2), and
- reactor coolant pressure boundary (RCPB) (Section 2.3.1.3).

License Renewal Drawings

License renewal drawings are not provided for the reactor vessel and the reactor vessel internals. For license renewal drawings associated with the reactor coolant pressure boundary, see Section 2.3.1.3.

2.3.1.1 Reactor Vessel

For the aging management review, the reactor pressure vessel includes the following major subcomponents: shell, lower head, upper closure head, flanges, studs, nuts, nozzles and safe ends. The vessel boundaries for the review are typically the weld between the safe end and attached piping or at the interface flange for bolted connections. The review includes thermal sleeves that are welded to vessel nozzles or safe ends, control rod drive stub tubes, control rod drive housings, incore monitor housings, the vessel support skirt, vessel interior welded attachments, and vessel external attachments.

Table 2.3.1-1 lists the reactor vessel components that require aging management review and their intended functions.

Table 3.1.2-1 provides the results of the aging management review for the reactor vessel.

2.3.1.2 Reactor Vessel Internals

The evaluation boundaries for the aging management review include the subcomponent groups identified in Section 2.3.1 under Reactor Vessel Internals. The following discussion clarifies which components are subject to aging management review.

- Shroud

  The upper, central and lower sections of the shroud cylinder provide support to the core and provide the floodable volume for core cooling. All sections of the shroud are subject to aging management review.

- Shroud head and steam separator assembly

  The steam separator assembly and shroud head, including hold-down bolting, do not fulfill a safety function. Failure evaluations of this subcomponent have determined that cracking, to the extent of creating a loose part, is unlikely to go undetected. Even if loose parts were generated, there is no significant safety concern from those postulated loose parts. Recent industry operating experience has shown that loose parts generated by the steam dryers can reach the steam lines. However, any loose parts generated by the steam separators would be captured by the steam dryers and would not reach the steam lines. Consequently, this subcomponent is not subject to aging management review.

- Shroud support assembly

  The shroud support assembly supports the shroud and core plate and provides a floodable volume, thus the assembly is subject to aging management review. This review includes the shroud support ring (three segments), the shroud support cylinder (four segments), the twenty-two shroud support gussets and the two shroud support access opening covers. The access opening covers are welded to the shroud support ring and are categorized as creviced. The weld to the reactor vessel pad for the shroud support is included in this evaluation. The pad, an extension of the vessel cladding, is reviewed with the reactor vessel (Section 2.3.1.1).

- Core support (core plate)

  The core plate is subject to aging management review as it supports the core and control rods. Bypass flow holes in the core plate have been plugged to eliminate in-core instrument vibration. The core plate plugs are not subject to aging management review because they will be replaced based on their qualified life as described in the BWR Vessel Internals Program. The core plate hold-down bolts are subject to aging management review.

- Top guide assembly

  The top guide assembly laterally supports the fuel assemblies and other core components and is subject to aging management review.

- Fuel support pieces

  The fuel support pieces support the core fuel elements and are subject to aging management review. The fuel support piece orifices provide the correct core coolant flow distribution.

- Fuel support plugs

  CNS utilizes fuel support plugs (dummy fuel assemblies) in 12 locations to act as one-quarter of the control rod channel needed to guide the control rod during control rod movement. As these assemblies are replaced based on condition, they are not long-lived components and are therefore not subject to aging management review.

- Control rod guide tubes and thermal sleeves

  The control rod guide tubes support the fuel and the control rods and as such are subject to aging management review. The control rod drive thermal sleeves lock the guide tubes into position and are also subject to aging management review.

- Jet pump assemblies

  The jet pump assemblies form part of the floodable volume around the core and are subject to aging management review. The recirculation nozzles, safe ends, and thermal sleeves are reviewed with the reactor vessel (Section 2.3.1.1). The rest of the Class 1 recirculation system outside the vessel is reviewed with the RCPB (Section 2.3.1.3).

- Steam dryers

  The steam dryer does not provide any safety function. However, loose parts caused by cracking can occur and may interfere with the safety function of other components (e.g., MSIVs). Consequently, the steam dryer is subject to aging management review as a non-safety-related component whose failure could prevent satisfactory accomplishment of any of the safety functions of other structures, systems, and components.

- Feedwater spargers

  The feedwater lines inside the reactor vessel do not provide any safety function. Failure of a feedwater sparger has been evaluated and shown not to affect the safe operation of other reactor vessel internals components. Consequently, the feedwater spargers do not perform any license renewal intended function and are therefore not subject to aging management review.

- Core spray lines

  The core spray lines function to distribute flow across the core and are subject to aging management review. This aging management review includes the core spray lines inside the vessel.

- Differential pressure and standby liquid control line

  The lines inside the reactor vessel have no safety function. Evaluations of these lines have shown that their failure would not have an adverse impact on achieving safe shutdown. Therefore, these lines are not subject to aging management review.

- Incore flux monitor dry tubes, guide tubes, and local power range monitor (LPRM)

  The incore flux monitor guide tubes provide support for the source and intermediate range flux detector dry tubes and the LPRMs and as such are subject to aging management review. The dry tubes for the source and intermediate range flux monitors are not subject to aging management review because they are subject to replacement based on qualified life or specified time period.

  The LPRM assemblies maintain the reactor coolant pressure boundary and are subject to aging management review.

- Initial startup neutron sources

  The initial startup neutron sources have been removed from the reactor vessel. The startup neutron source core locations are occasionally used for irradiation of materials test capsules in the CNS core but do not provide a safety function. Consequently, these subcomponents are not subject to aging management review.

- Surveillance sample holders

  The surveillance sample holders do not fulfill a safety function. Evaluations of these components have determined that a loose part such as a surveillance sample holder is not expected to create an unsafe condition. Consequently, this subcomponent is not subject to aging management review.

- Guide rods

  The guide rods are used for alignment of the shroud head and steam dryer during assembly and disassembly of the reactor vessel internals. The guide rods serve no safety function. A review of the failure consequences of loose parts similar to the guide rods concluded these loose parts are unlikely to create an unsafe condition. Therefore, the guide rod subcomponents are not subject to aging management review.

- Jet pump instrumentation

  CNS Technical Specifications require surveillance of jet pump flows as an indication of jet pump integrity. In addition, core flow measurement accuracy is affected by sensing line failure. However, while this instrumentation is required for operation, it is not required for safe shutdown (when jet pumps are not operating). Therefore, jet pump instrumentation inside the vessel has no license renewal function and is not subject to aging management review.

Table 2.3.1-2 lists the reactor vessel internals components that require aging management review and their intended functions.

Table 3.1.2-2 provides the results of the aging management review for reactor vessel internals components.

2.3.1.3 Reactor Coolant Pressure Boundary

The aging management review of the RCPB includes components that are part of the RCPB other than the reactor vessel and its internals. The major components of the RCPB include the reactor vessel, reactor recirculation loops, and the Class 1 portions of various systems connected to the reactor vessel. The Class 1 components of the systems listed below are included in the RCS aging management review. The non-Class 1 portions of the systems listed below are reviewed as referenced. System descriptions are provided in the referenced sections.

- Control rod drive (CRD) (Section 2.3.3.2)
- Core spray (CS) (Section 2.3.2.2)
- Reactor feedwater (RF) (Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2), under Reactor Feedwater)
- High pressure coolant injection (HPCI) (Section 2.3.2.4)
- Main steam (MS) (Section 2.3.4.1, MSIV Leakage Pathway under Main Steam)
- Nuclear boiler instrumentation (NBI) (Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) under Nuclear Boiler Instrumentation)
- Reactor core isolation cooling (RCIC) (Section 2.3.2.5)
- Reactor recirculation (RR) (Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) under Reactor Recirculation)
- Reactor water cleanup (RWCU) (Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) under Reactor Water Cleanup)
- Residual heat removal (RHR) (Section 2.3.2.1)
- Standby liquid control (SLC) (Section 2.3.3.1)

Class 1 piping attached to the vessel nozzles, flanges or safe ends, Class 1 pumps, and Class 1 boundary isolation valves are passive, long-lived components included in this aging management review. In addition, this review includes connected piping and components beyond the Class 1 boundary that are not reviewed in other non-Class 1 aging management reviews.

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

Table 3.1.2-3 provides the results of the aging management review for RCPB components.

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2026-SH01	LRA-2039	LRA-2043
LRA-2026-SH02	LRA-2040-SH01	LRA-2044
LRA-2027-SH01	LRA-2040-SH02	LRA-2045-SH01
LRA-2027-SH02	LRA-2041	LRA-2045-SH02
LRA-2028	LRA-2042-SH01	

Table 2.3.1-1
Reactor Vessel
Components Subject to Aging Management Review

Component Type	Intended Function
Attachments and Supports	
Reactor vessel external attachments • Stabilizer brackets • Support skirt	Structural support
Reactor vessel internal attachment welds • Core spray brackets • Dryer support brackets • Feedwater sparger brackets • Guide rod brackets • Jet pump riser support pads • Surveillance specimen holder brackets • Dryer holddown brackets	Structural support
Bolting	
Incore monitor housing bolting • Capscrews and washers: CRD flange bolting • Capscrews and washers	Pressure boundary
Other bolting • Upper head nozzle flange bolts	Pressure boundary
Reactor vessel closure flange bolting • Closure studs, nuts, washers and bushings	Pressure boundary
Nozzles and Penetrations	
CRD housings	Pressure boundary
CRD stub tubes	Pressure boundary
Incore monitor housings	Pressure boundary

Table 2.3.1-1 (Continued)
Reactor Vessel
Components Subject to Aging Management Review

Component Type	Intended Function
Nozzles • Core spray (N5A/B) • Jet pump instrument (N8A/B) • Recirc outlet (N1A/B) • Recirc inlet (N2A–K) • Core ΔP / SLC (N10) • Instrumentation (N11A/B, N12A/B, N16 A/B) • CRD return (N9) • Drain (N15) • Feedwater (N4A–D) • High pressure RPV head seal leak detection (N13) • Main steam (N3A–D) • Head vent (N7) • Spare (N6A/B)	Pressure boundary
Safe Ends, Thermal Sleeves, Flanges, Caps	
CRD return line cap (N9)	Pressure boundary
Nozzle (head) flanges • Blank flanges (N6A/B) • Nozzle flanges (N6A/B, N7)	Pressure boundary
Nozzle safe ends $\geq$ 4 inch nominal pipe size (NPS) • Core spray (N5A/B) including thermal sleeve • Jet pump instrument (N8A/B) • Recirc inlet (N2A–K) including thermal sleeve • Recirc outlet (N1A/B) • Feedwater (N4A–D) • Main steam (N3A–D)	Pressure boundary

Table 2.3.1-1 (Continued)
Reactor Vessel
Components Subject to Aging Management Review

Component Type	Intended Function
Nozzle safe ends < 4 inch NPS • Core ΔP / SLC (N10) • Instrumentation (N11A/B, N12A/B, N16A/B)	Pressure boundary
Nozzle to safe end welds • Core spray (N5A/B) • Jet pump instrument (N8A/B) • Recirc inlet/outlet (N1A/B, N2A–K)	Pressure boundary
Shell and Heads	
Reactor vessel bottom head	Pressure boundary
Reactor vessel shell • Closure flange • Lower shell and lower intermediate beltline shell and connecting welds • Upper intermediate and upper shell	Pressure boundary
Reactor vessel upper head • Closure flange • Top head (dome)	Pressure boundary

Table 2.3.1-2
Reactor Vessel Internals
Components Subject to Aging Management Review

Component Type	Intended Function
Control rod guide tubes • Tube, thermal sleeve • Base	Structural support
Core spray lines	Flow distribution
Core plate assembly	Structural support
Core plate assembly • Hold-down bolts	Structural support
Fuel support pieces (includes 4-lobe and peripheral)	Structural support
Fuel support orifices	Flow distribution
Incore flux monitors • Guide tubes	Structural support
Incore flux monitors • LPRMs	Pressure boundary
Jet pump assemblies • Riser pipe, elbow, brace • Hold-down bolt mixer throat (barrel) • Restrainer bracket wedge assemblies • Diffuser shell, tailpipe, adapter (top piece) • Hold-down beam • Diffuser adapter (bottom piece) • Transition piece • Suction inlet elbow/nozzle • Mixer adapter • Restrainer bracket • Diffuser collar	Floodable volume
Shroud	Structural support Floodable volume

Table 2.3.1-2 (Continued)
Reactor Vessel Internals
Components Subject to Aging Management Review

Component Type	Intended Function
Shroud support	Structural support Floodable volume
Steam dryer	Structural integrity
Top guide assembly	Structural support

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

Component Type	Intended Function
Bolting	Pressure boundary
Condensing chambers	Pressure boundary
Control rod drive	Pressure boundary
Flow element	Flow control
Flow element (non-Class 1)	Pressure boundary
Instrument line snubber (non-Class 1)	Pressure boundary
Piping and fittings < 4 inch NPS	Pressure boundary
Piping and fittings ≥ 4 inch NPS	Pressure boundary
Piping and fittings (non-Class 1)	Pressure boundary
Pump casing	Pressure boundary
Pump casing-RR driver mount	Pressure boundary
Pump cover thermal barrier	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Thermal sleeve	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Tubing (non-Class 1)	Pressure boundary
Valve body < 4 inch NPS	Pressure boundary
Valve body (non-Class 1)	Pressure boundary
Valve body ≥ 4 inch NPS	Pressure boundary

2.3.2 Engineered Safety Features

The engineered safety features (ESF) are described in USAR Chapters IV, V, and VI.

The following systems are described in this section.

- Section 2.3.2.1, Residual Heat Removal
- Section 2.3.2.2, Core Spray
- Section 2.3.2.3, Automatic Depressurization
- Section 2.3.2.4, High Pressure Coolant Injection
- Section 2.3.2.5, Reactor Core Isolation Cooling
- Section 2.3.2.6, Standby Gas Treatment
- Section 2.3.2.7, Primary Containment
- Section 2.3.2.8, ESF Systems in Scope for 10 CFR 54.4(a)(2)

2.3.2.1 Residual Heat Removal

System Description

The purpose of the residual heat removal (RHR) system is to restore and maintain the coolant inventory in the reactor vessel so that the core is adequately cooled after a loss of coolant accident (LOCA) and to provide residual heat removal capability when the main condenser heat sink is unavailable (normal shutdown). The RHR system also provides post-LOCA cooling for the drywell, thereby removing heat from the primary containment to reduce containment pressure and temperature, and for the suppression pool.

The RHR system consists of four main pumps, two heat exchangers, and associated piping and valves. One loop, consisting of one heat exchanger, two main pumps in parallel and associated piping, is physically separated from the second loop to minimize the possibility of a single physical event causing loss of the entire system. The two loops can be interconnected via a cross-tie shutoff valve; the valve is maintained closed to prevent loss of both loops during a LOCA. The system discharge piping is kept filled to ensure rapid delivery of water to the reactor pressure vessel and to minimize water hammer effects.

The RHR system has the following modes of operation.

- low pressure coolant injection (LPCI)
- containment spray (drywell spray and suppression chamber spray)
- suppression pool cooling
- shutdown cooling
- fuel pool cooling

LPCI operates in combination with other emergency core cooling systems to restore and, if necessary, maintain the coolant inventory in the reactor vessel after a LOCA. During LPCI operation, the main system pumps take suction from the suppression pool and discharge to the reactor vessel into the core region through both of the recirculation loops. Water lost from the vessel through a break in the piping within the primary containment returns to the suppression pool through the pressure suppression vent pipes. LPCI and the core spray system provide protection to the core for the case of a large break in the reactor coolant pressure boundary when level cannot be maintained and the reactor vessel rapidly depressurizes. Protection extends to a small break in which HPCI is unable to maintain reactor water level and the automatic depressurization system (ADS) has operated to lower reactor vessel pressure.

The containment spray mode provides a method for reducing containment pressure and temperature following a LOCA. Water pumped through the RHR heat exchangers can be diverted to spray headers in the drywell and above the suppression pool. The spray headers in the drywell condense any steam that may exist in the drywell, thereby lowering containment pressure and temperature. The spray collects in the bottom of the drywell until the water level rises to the level of the pressure suppression vent pipes where it overflows and drains back to the suppression pool. A portion of this spray flow may be directed to the suppression chamber spray ring to cool any non-condensable gases collected in the free volume above the suppression pool.

Suppression pool cooling is placed in operation to remove heat from the suppression pool to reduce pressure in the primary containment following a LOCA. In this mode, the RHR system pumps are aligned to pump water from the suppression pool through the RHR heat exchangers, where heat is transferred to the service water system. Flow returns to the suppression pool via return lines which discharge below the pool surface.

Shutdown cooling is placed in operation during a normal reactor shutdown and cooldown. When steam supply pressure is no longer sufficient to maintain vacuum in the main condenser, the RHR system is placed in the shutdown cooling mode to complete the cooldown. Reactor coolant is pumped by the RHR main system pumps from one recirculation loop through the RHR heat exchanger(s) where heat is transferred to the service water system. Operation of one heat exchanger is adequate to remove decay heat. Reactor coolant is returned to the reactor vessel through connections to the recirculation loops.

The RHR system may also be used to support the fuel pool cooling system. This capability increases the spent fuel pool cooling capacity if additional cooling is necessary to maintain fuel pool temperature below 150°F. The RHR system intertie to the fuel pool cooling system is sized to assist with removing the decay heat of a full core off-load plus the spent fuel discharged from previous refuelings. This function is not a safety function of the RHR system.

The RHR system can deliver water to the fuel pool diffusers via the RHR-fuel pool cooling intertie. This serves as an alternate source of water for the spent fuel pool. The water supply for the RHR system can come from the suppression pool, a condensate storage tank, or the RHR service water booster system.

Alignment of an RHR pump suction to a condensate storage tank allows refueling operations with the suppression pool drained and the RHR system providing core reflooding capability.

A piping connection from the RHR service water booster pumps to the RHR piping system is sized to provide 4000 gpm of service water to the reactor vessel at 0 psig reactor pressure. This “unlimited makeup” alignment for emergency core flooding is beyond the design basis of the plant and is not a safety function.

Two components in the RHR system code support the pressure boundary of the high pressure coolant injection (HPCI) system.

The RHR system has the following intended functions for 10 CFR 54.4(a)(1).

- Restore and maintain reactor vessel coolant inventory after a LOCA.
- Provide drywell and suppression spray to remove containment heat following a LOCA.
- Provide cooling for the suppression pool.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment isolation.

The RHR system has the following intended function for 10 CFR 54.4(a)(2).

- Provide alternate water supply to the spent fuel pool.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The RHR system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (suppression pool cooling mode and shutdown cooling mode for normal or alternate shutdown).

USAR References

Section IV-8; Section VI-3

Components Subject to Aging Management Review

ASME Class 1 components with the intended function of maintaining the reactor coolant pressure boundary are reviewed with the RCS (Section 2.3.1.3). Two components that maintain the pressure boundary of the HPCI system are reviewed with that system (Section 2.3.2.4). Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with ESF systems in scope for (a)(2) (Section 2.3.2.8). Remaining RHR components are reviewed as listed below.

Table 2.3.2-1 lists the component types that require aging management review.

Table 3.2.2-1 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2031-SH02	LRA-2041
LRA-2036-SH01	LRA-2043
LRA-2040-SH01	LRA-2044
LRA-2040-SH02	LRA-2084

2.3.2.2 Core Spray

System Description

The purpose of the core spray (CS) system is to protect the core by spraying water over the fuel assemblies to remove decay heat following the postulated design basis loss-of-coolant accident (LOCA). As part of the emergency core cooling systems (ECCS), the core spray system provides low pressure emergency core cooling in time and at a sufficient rate to cool the core and limit fuel clad temperature. The ECCS, in conjunction with the primary and secondary containments, limits the release of radioactive materials to the environs following a LOCA. The CS and LPCI systems provide protection to the core for the case of a large break in the reactor coolant pressure boundary when level cannot be maintained and the reactor vessel rapidly depressurizes. Protection extends to a small break in which HPCI is unable to maintain reactor water level and the automatic depressurization system (ADS) has operated to lower reactor vessel pressure.

The CS system consists of two independent loops, each of which contains a centrifugal pump, a spray sparger in the reactor vessel above the core, and associated piping and valves to convey water from the suppression pool to the sparger. The primary source of water for the CS system is the suppression pool. A secondary source of water is the condensate storage tank (CST), which can be aligned to the suction of the core spray pumps during refueling operations to provide core reflooding capability. The system discharge piping is kept in a filled condition to minimize water hammer effects on system initiation.

The CS system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide cooling water to the area above the core during accident conditions to cool the core and limit fuel cladding temperature.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment isolation.

The CS system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CS system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

USAR References

Section VI, ECCS (description in Section VI-4.3)

Components Subject to Aging Management Review

ASME Class 1 components with the intended function of maintaining the reactor coolant pressure boundary are reviewed with the RCS (Section 2.3.1.3). Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with ESF systems in scope for (a)(2) (Section 2.3.2.8). Remaining CS components are reviewed as listed below.

Table 2.3.2-2 lists the component types that require aging management review.

Table 3.2.2-2 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2026-SH01
LRA-2045-SH01
LRA-2045-SH03

2.3.2.3 Automatic Depressurization

System Description

The purpose of the automatic depressurization system (ADS) is to serve, in conjunction with LPCI and core spray, as a back-up to the HPCI under LOCA conditions. If the HPCI system does not operate, or during a small break LOCA in which HPCI is unable to maintain reactor water level, the reactor coolant system is depressurized sufficiently to permit the LPCI and core spray systems to operate to protect the fuel barrier.

The ADS is comprised of components in the main steam system. These include six of the eight safety/relief valves (SRVs) located on the main steam lines inside the drywell, before the first main steam isolation valve (MSIV). Depressurization occurs when some of the SRVs are opened automatically or manually to vent steam to the suppression pool. Motive force for SRV operation is normally provided by nitrogen. Backup air from the instrument air system can be supplied. The valves also have accumulators that will provide for the necessary valve actuations.

The pilot-operated SRVs discharge to the suppression pool. SRV discharge is piped through individual discharge lines to T-quenchers located below the minimum water level in the suppression pool. Two 10-inch vacuum relief valves are provided on each SRV discharge line in the drywell to prevent drawing water up into the line due to steam condensation following termination of relief valve operation.

Since their configuration is identical to the ADS relief valves, the remaining two of eight relief valve tailpipes and associated T-quenchers and vacuum breaker and instrument valve bodies are included in this evaluation.

The ADS system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide RCS depressurization as a backup to HPCI to allow flow from LPCI and core spray to enter the reactor vessel.
- Maintain integrity of reactor coolant pressure boundary.

The ADS system has no intended functions for 10 CFR 54.4(a)(2).

The ADS system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

USAR References

Section IV-4.5.1, VI-4.2

Components Subject to Aging Management Review

The safety/relief valves themselves, the safety valves, and other piping and components upstream of the valves are included with the reactor coolant system pressure boundary (Section 2.3.1.3) since they are part of the nuclear system Class 1 pressure boundary. Remaining ADS components are reviewed as listed below.

Table 2.3.2-3 lists the component types that require aging management review.

Table 3.2.2-3 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2027-SH01

LRA-2027-SH02

LRA-2028

2.3.2.4 High Pressure Coolant Injection

System Description

The purpose of the high pressure coolant injection (HPCI) system, as part of the emergency core cooling systems (ECCS), is to limit, in conjunction with the primary and secondary containments, the release of radioactive materials to the environs following a loss-of-coolant accident (LOCA). HPCI provides protection to the core for the case of a small break in the reactor coolant pressure boundary which does not result in rapid depressurization of the reactor vessel. HPCI permits the nuclear plant to be shutdown while maintaining sufficient reactor vessel water inventory until the reactor vessel is depressurized. HPCI continues to operate until reactor vessel pressure is below the pressure at which LPCI or core spray operation can maintain core cooling.

The HPCI system consists of a steam turbine, a turbine-driven pump (main pump and booster pump in tandem), a direct current (DC) motor-driven auxiliary oil pump, a gland seal condenser with supporting components, and associated piping and valves. HPCI is designed to pump water into the reactor vessel for a wide range of pressures. The suppression pool provides the required source of water for the HPCI system, and the emergency condensate storage tanks (ECSTs) are available for HPCI as well. Pump suction is normally aligned to the ECSTs to minimize injection of suppression pool water into the reactor vessel. However, if ECST water level is low or suppression pool water level is high, pump suction automatically transfers to the suppression pool. Water from either source is pumped into the reactor vessel via a feedwater line. Flow is distributed within the reactor vessel through the feedwater spargers to obtain mixing with the hot water or steam in the reactor pressure vessel. Discharge lines are kept full of water using a “keep fill” system to ensure rapid delivery of water to the reactor vessel and to minimize water hammer effects.

Decay heat and residual heat generate steam in the reactor, a portion of which is extracted from a main steam header upstream of the main steam line isolation valves to drive the HPCI system turbine. Two isolation valves in the steam line to the HPCI turbine are normally open to keep the piping to the turbine at elevated temperatures to permit rapid startup of the HPCI system. A condensate drain pot is upstream of the turbine stop valve to prevent the HPCI steam supply line from filling with water. The condensate is normally routed to the main condenser, but upon receipt of a “steam-to-turbine valve not full closed” signal or a loss of control air pressure, isolation valves on the drain line shut automatically. Exhaust steam from the HPCI turbine is discharged to the suppression pool. The steam exhaust line is provided with vacuum breakers (check valves) to prevent the line from being flooded by siphoned water from the suppression pool.

HPCI turbine gland and system valve seals are vented to the HPCI system gland seal condenser. Part of the water from the HPCI booster pump discharge is routed through the condenser for cooling purposes. Non-condensable gases from the gland seal condenser are pumped to the standby gas treatment system. Startup of the gland seal equipment is automatic, but its failure would not prevent HPCI from fulfilling its core cooling objective.

A lube oil system for HPCI provides control oil to operate the turbine stop and control valve, the actuator oil pump of the governor control system, main pump bearings and reduction gear, mechanical-hydraulic automatic reset overspeed trip system, thrust bearing and thrust bearing wear detector, and turbine bearings. A motor-driven pump is used when speed is too low for the shaft-driven pump to supply the lube oil system. A lube oil cooler is supplied water from the booster pump discharge.

The HPCI system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide reactor makeup for core cooling following a design basis accident that results in low reactor vessel level or high drywell pressure.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment isolation.

The HPCI system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The HPCI system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (includes the test return line to the ECSTs).
- Perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63).

USAR References

Section VI, ECCS (summary description in Section VI-3.0, description in Section VI-4.1)

Components Subject to Aging Management Review

ASME Class 1 components with the intended function of maintaining the reactor coolant pressure boundary are reviewed with the RCS (Section 2.3.1.3). Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with ESF systems in scope for (a)(2) (Section 2.3.2.8). Remaining HPCI components are reviewed as listed below.

Table 2.3.2-4 lists the component types that require aging management review.

Table 3.2.2-4 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2041	LRA-2049-SH02
LRA-2044	LRA-C-891-X

2.3.2.5 Reactor Core Isolation Cooling

System Description

The purpose of the reactor core isolation cooling (RCIC) system is to provide makeup water to the reactor vessel following a reactor vessel isolation accompanied by a loss of coolant flow from the feedwater system to provide adequate core cooling and control of the reactor vessel water level. Although the RCIC system is not part of the emergency core cooling systems (ECCS) as described in USAR Section VI-3.0, it is included with the ESF discussion (consistent with NUREG-1801 Chapter V Section D.2) because of its similar functions. The RCIC system also provides makeup water to the reactor vessel during a station blackout and provides an alternate boration flowpath to the standby liquid control system.

The RCIC system consists of a steam-driven turbine-pump unit and associated valves and piping capable of delivering make-up water to the reactor vessel. The system also includes a lube oil supply system and a barometric condenser. The barometric condenser is not required for RCIC system operation to mitigate a transient or an SBO event.

Suction piping is provided from the ECSTs and the suppression pool. Pump suction is normally aligned to the ECSTs to minimize injection of suppression pool water into the reactor vessel. However, if ECST water level is low, pump suction automatically transfers to the suppression pool. Water from either source is pumped into the reactor vessel via a feedwater line. Flow is distributed within the reactor vessel through the feedwater spargers. Discharge lines are kept full of water using a “keep fill” system to ensure rapid delivery of water to the reactor vessel and to minimize water hammer effects. The pump also provides cooling water to the RCIC turbine lube oil cooler and the barometric condenser.

Steam generated by decay heat and residual heat in the reactor is extracted from a main steam line upstream of the associated inboard main steam line isolation valve to drive the turbine. Accumulated condensate from the steam line is routed to the barometric condenser. Steam supply piping is maintained at an elevated temperature to minimize condensation in the supply piping when the system is initiated. Exhaust steam is discharged to the suppression pool. Exhaust piping is provided with a drip leg for condensate removal, which drains accumulated condensate back to the barometric condenser. The steam exhaust line is provided with vacuum breakers (check valves) to prevent the line from being flooded by siphoned water from the suppression pool.

The lube oil system provides lubricating oil for the turbine bearings and control oil to operate the governor and turbine trip and throttle valve. The lube oil pump is gear-driven from the RCIC turbine. Oil is discharged through an oil filter and cooler to the turbine bearing boxes, the trip and throttle valve, and the governor valve.

The RCIC system serves as an alternate to the standby liquid control system for injection of borated water to the reactor vessel. The RCIC pump suction may be manually connected to the standby liquid control tank. This mode of operation is not a safety function.

The RCIC system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide makeup water to the reactor vessel following a reactor vessel isolation to prevent the release of radioactive materials to the environs as a result of inadequate core cooling.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment isolation.

The RCIC system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The RCIC system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).
- Perform a function that demonstrates compliance with the Commission’s regulations for station blackout (10 CFR 50.63).

USAR References

Section IV-7

Components Subject to Aging Management Review

ASME Class 1 components with the intended function of maintaining the reactor coolant pressure boundary are reviewed with the RCS (Section 2.3.1.3). Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with ESF systems in scope for (a)(2) (Section 2.3.2.8). Remaining RCIC components are reviewed as listed below.

Table 2.3.2-5 lists the component types that require aging management review.

Table 3.2.2-5 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2041

LRA-2043

LRA-CNS-RCIC-1

2.3.2.6 Standby Gas Treatment

System Description

The purpose of the standby gas treatment (SGT) system is to process gaseous effluent from the reactor building when required to limit the discharge of radioactive materials to the environs. The SGT system functions as part of the secondary containment system, which also provides primary containment when the primary containment is open for maintenance or refueling. With the reactor building isolated, the system is designed to reduce the average reactor building pressure to a subatmospheric pressure while filtering the exhaust.

The SGT system has two fully redundant trains. Each train contains a moisture separator, a rough prefilter, an electric heater to reduce humidity, a high-efficiency particulate air (HEPA) filter, charcoal adsorbers, a downstream HEPA filter, and a centrifugal fan. The system discharges to an elevated release point (ERP) through a 10-inch underground line. A redundant, cross-connected line is provided from the reactor building to the ERP.

Both trains of the system start automatically on a reactor building high radiation signal, a high drywell pressure signal, or a low reactor water level signal. Upon verification that both trains are operating, the redundant train is normally shut down.

Drywell and suppression chamber purge exhaust can be directed to the SGT system for processing before release to the ERP. The HPCI gland seal steam condenser exhauster discharge is also routed to the SGT system. These functions are not safety functions.

The SGT system has the following intended functions for 10 CFR 54.4(a)(1).

- Maintain reactor building atmosphere at a negative pressure to prevent uncontrolled leakage from the reactor building to the environs.
- Provide for removal of particulates and iodine by filtration prior to release.

The SGT system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The SGT system has no intended functions for 10 CFR 54.4(a)(3).

USAR References

Sections V-3.0, VII-17.0, XIV-8.2

Components Subject to Aging Management Review

Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with ESF systems in scope for (a)(2) (Section 2.3.2.8). Remaining SGT system components are reviewed as listed below.

Table 2.3.2-6 lists the component types that require aging management review.

Table 3.2.2-6 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2005-SH02	LRA-2022-SH01
LRA-2020	LRA-2037

2.3.2.7 Primary Containment

System Description

The primary containment (PC) system is the system code containing components associated with primary containment. The purpose of the PC system is to maintain primary containment integrity subsequent to accidents. Primary containment houses the reactor pressure vessel, the reactor coolant recirculation system, and other branch connections of the reactor coolant system. Primary containment is a pressure suppression system consisting of a drywell, a toroidal suppression chamber which stores a large volume of water (suppression pool), a connecting vent system between the drywell and suppression pool, isolation valves, vacuum relief system, portions of the emergency core cooling system, and other service equipment. Structural primary containment components are evaluated in Section 2.4.1, Reactor Building and Primary Containment.

The PC system includes torus-to-drywell vacuum breakers, drywell-to-reactor building vacuum breakers, and containment isolation valves associated with several different plant systems. Two components support the RHR system pressure boundary.

The PC system has the following intended functions for 10 CFR 54.4(a)(1).

- Support primary containment integrity.
- Maintain proper differential pressure among the torus, drywell, and reactor building (function is performed by vacuum breakers).

The PC system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The PC system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

The review of the PC system includes mechanical components associated with containment penetrations, primarily piping and valves, that are components in other systems that are not included in a system-level aging management review. Two of these systems, Neutron Monitoring and Neutron Monitoring—TIP, are described in this section because their only intended function is performed by a containment penetration. For a list of other systems with containment penetration components included in this review, see Components Subject to Aging Management Review below. The grouping of containment isolation valves from various plant systems into a consolidated review is appropriate as indicated in NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Section 2.1.3.1.

Neutron Monitoring

The purpose of the neutron monitoring (NM) system is to monitor the neutron flux level (i.e., reactor power) in the reactor core from startup to full reactor power (10^{-9} to 125% thermal power). The NM system consists of six subsystems.

- source range monitor
- intermediate range monitor
- local power range monitor
- average power range monitor
- rod block monitor
- traversing in-core probe (TIP)

The majority of components in the NM system are EIC components; however, the NM system code includes valves associated with the traversing in-core probes and is therefore included in the evaluation of mechanical systems. This set of valves includes components that support primary containment isolation and the nitrogen system pressure boundary.

While the neutron monitoring subsystems have safety functions relating to providing inputs to reactor scram signals, the only mechanical intended function of the NM system is to support primary containment isolation.

The NM system has the following mechanical intended functions for 10 CFR 54.4(a)(1).

- Support primary containment isolation.

The NM system has no intended functions for 10 CFR 54.4(a)(2) or (a)(3).

Neutron Monitoring—TIP

The purpose of the neutron monitoring—TIP (NMT) system is to provide a signal proportional to the axial gamma flux distribution to allow reliable calibration of the LPRM detectors.

The NMT system includes four traversing in-core probe channels, each of which has a traversing in-core probe, a drive mechanism, an indexing mechanism, up to ten in-core guide tubes, and a chamber shield.

The NMT system includes ball valves and shear valves which have the safety function of isolating primary containment. The purpose of the valve assembly is to provide a means to isolate the TIP guide tube to ensure primary containment integrity if a leak develops in the guide tube portion of the in-core detector assembly. Each valve assembly consists of a solenoid-operated ball valve and an explosive-operated shear valve. One valve assembly is installed in each of the four guide tubes. The ball valve provides the normal means of sealing a guide tube. The ball valve closes automatically upon receipt of a primary containment isolation signal. The shear valve is a back-up safety device which has a chisel-type plunger that is driven into the guide tube with enough force to shear the drive cable and seal the reactor end of the guide tube. The shear valve provides an emergency means of sealing a guide tube to ensure primary containment integrity should the normal isolation (i.e., the ball valve) fail.

The NMT system has the following intended function for 10 CFR 54.4(a)(1).

- Support primary containment isolation.

The NMT system has no intended functions for 10 CFR 54.4(a)(2) or (a)(3).

USAR References

PC: Section V-2.0

NM: Section VII-5.0

NMT: Section VII-5.11

Components Subject to Aging Management Review

PC system components maintaining the RHR system pressure boundary are reviewed with the RHR system (Section 2.3.2.1). Components associated with the torus hard pipe vent are reviewed with the SGT system (Section 2.3.2.6). PC system components associated with the instrument air system are reviewed with the instrument air system (Section 2.3.3.10). Nonsafety-related components of the PC system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with ESF systems in scope for (a)(2) (Section 2.3.2.8). PC and NM system components that support the nitrogen system pressure boundary are reviewed with the nitrogen system (Section 2.3.3.13).

Primary containment structural components, including equipment and personnel hatches, are evaluated with the reactor building structure (Section 2.4.1). The internals of electrical penetration assemblies are reviewed with the electrical systems (Section 2.5).

Mechanical components associated with primary containment penetrations in systems with their own aging management review are reviewed with their respective systems, with the exception of control rod drive components associated with penetration leakage rate tests (penetration X36, hydrogen/oxygen monitoring), which are included in this review. In addition to the NM, NMT, and PC systems described above, the review of the PC system includes mechanical components associated with containment penetrations, primarily piping and valves, that are components in the control rod drive system (Section 2.3.3.2), demineralized water system (Section 2.3.3.14), radiation monitoring–ventilation system (Section 2.3.3.14), and radioactive waste system (Section 2.3.3.12).

Primary containment penetrations not included in other system aging management reviews are reviewed as listed below.

Table 2.3.2-7 lists the component types that require aging management review.

Table 3.2.2-7 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2022-SH01
LRA-2022-SH02
LRA-2026-SH01
LRA-2027-SH01
LRA-2027-SH02
LRA-2028
LRA-2029
LRA-2031-SH01
LRA-2038-SH01
LRA-2044
LRA-2045-SH01
LRA-2083
LRA-2084
LRA-117C3303-SH04
LRA-117C3303-SH05
LRA-117C3303-SH06
LRA-117C3303-SH07

2.3.2.8 ESF Systems in Scope for 10 CFR 54.4(a)(2)

As discussed in Sections 2.1.1.2 and 2.1.2.1.2, systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) interact with safety-related systems in one of two ways: functional or physical. A functional failure is one where the failure of a nonsafety-related SSC to perform its function impacts a safety function. A physical failure is one where a safety function is impacted by the loss of structural or mechanical integrity of an SSC.

Functional Failure

Functional failures of nonsafety-related SSCs which could impact a safety function are identified with the individual system's evaluation and are not discussed in this section.

Physical Failure

This section summarizes the scoping and screening results for ESF systems based on 10 CFR 54.4(a)(2) because of the potential for physical interactions with safety-related equipment. Physical failures may be related to structural support or to spatial interaction.

Nonsafety-Related Systems or Components Directly Connected to Safety-Related Systems (Structural Support)

At CNS, certain components and piping outside the safety class pressure boundary must be structurally sound in order to maintain the pressure boundary integrity of safety class piping. Systems containing such nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems) are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2).

Nonsafety-Related Systems or Components with the Potential for Spatial Interaction with Safety-Related Systems or Components

The following modes of spatial interaction are described in Sections 2.1.1.2 and 2.1.2.1.2.

Physical Impact or Flooding

The evaluation of interactions due to physical impact or flooding resulted in the inclusion of structures and structural components. Structures and structural components are reviewed in Section 2.4.

Pipe Whip, Jet Impingement, or Harsh Environments

Systems containing nonsafety-related high energy lines that can affect safety-related equipment are included in this review. Where this criterion affected ESF systems, those systems are within the scope of license renewal per 10 CFR 54.4(a)(2).

Leakage or Spray

Nonsafety-related portions of safety-related systems containing oil, steam or liquid are considered within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) if such components are located in a space containing safety-related SSCs. ESF systems meeting this criterion are within the scope of license renewal per 10 CFR 54.4(a)(2).

The following ESF systems, described in the referenced sections, are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) for physical interactions.

- Section 2.3.2.1, Residual Heat Removal
- Section 2.3.2.2, Core Spray
- Section 2.3.2.4, High Pressure Coolant Injection
- Section 2.3.2.5, Reactor Core Isolation Cooling
- Section 2.3.2.6, Standby Gas Treatment
- Section 2.3.2.7, Primary Containment

System Descriptions

The ESF systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) because of the potential for physical interactions between nonsafety-related components and safety-related equipment are described in the sections referenced above.

USAR References

For USAR references for these systems, see the sections referenced above.

Components Subject to Aging Management Review

For structural support, components subject to aging management review are those nonsafety-related components connected to safety-related components up to the first seismic anchor or base-mounted component. Scope was typically determined by the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a base-mounted component, flexible connection, or the end of a piping run (such as a vent or drain line).

For spatial interaction, ESF system components containing oil, steam, or liquid and located in spaces containing safety-related equipment are subject to aging management review in this 54.4(a)(2) review if not already included in another system review. Components are excluded from review if their location is such that no safety function can be impacted by component failure. If a HELB analysis assumes that nonsafety-related piping in an ESF system does not fail or assumes failure only at specific locations, then that piping is within the scope of license renewal per 10 CFR 54.4(a)(2). Appropriate components are subject to aging management review in order to provide reasonable assurance that those analysis assumptions remain valid through the period of extended operation.

Series 2.3.2-8-xx tables list the component types for ESF systems that require aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Series 3.2.2-8-xx tables provide the results of the aging management review for ESF systems for 10 CFR 54.4(a)(2) based on potential for physical interactions.

System Name	Series 2.3.2-8-xx Table	Series 3.2.2-8-xx Table
RHR	Table 2.3.2-8-1	Table 3.2.2-8-1
CS	Table 2.3.2-8-2	Table 3.2.2-8-2
HPCI	Table 2.3.2-8-3	Table 3.2.2-8-3
RCIC	Table 2.3.2-8-4	Table 3.2.2-8-4
SGT	Table 2.3.2-8-5	Table 3.2.2-8-5
PC	Table 2.3.2-8-6	Table 3.2.2-8-6

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

System	Drawing Numbers	
RHR	LRA-2040-SH01 LRA-2040-SH02	LRA-2041 LRA-2043
CS	LRA-2045-SH01	
HPCI	LRA-2037 LRA-2041	LRA-2044 LRA-2049-SH02
RCIC	LRA-2041 LRA-2043	
SGT	LRA-2037	
PC	LRA-2020 LRA-2022-SH01 LRA-2022-SH02	LRA-2027-SH01 LRA-2027-SH02 LRA-2084

Table 2.3.2-1
Residual Heat Removal System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Cyclone - separator	Pressure boundary Filtration
Flange	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Pressure boundary Heat transfer
Instrument snubber	Pressure boundary
Nozzle	Flow control
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Strainer	Filtration
Thermowell	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.2-2
Core Spray System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Cyclone - separator	Pressure boundary Filtration
Flange	Pressure boundary
Flow element	Pressure boundary
Instrument snubber	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Strainer	Filtration
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.2-3
Automatic Depressurization System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Piping	Pressure boundary
T-quencher	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.2-4
High Pressure Coolant Injection System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Cyclone - separator	Pressure boundary Filtration
Filter housing	Pressure boundary
Flex hose	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Pressure boundary Heat transfer
Instrument snubber	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Reduction gear housing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Restriction orifice body	Pressure boundary
Sight glass	Pressure boundary
Strainer	Filtration
Tank	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary

**Table 2.3.2-4
High Pressure Coolant Injection System
Components Subject to Aging Management Review
(Continued)**

Component Type	Intended Function(s)
Tubing	Pressure boundary
Turbine casing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.2-5
Reactor Core Isolation Cooling System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Cyclone - separator	Pressure boundary Filtration
Filter	Filtration
Filter housing	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Pressure boundary Heat transfer
Instrument snubber	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Restriction orifice body	Pressure boundary
Sight glass	Pressure boundary
Strainer	Filtration
Tank	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary

Table 2.3.2-5
Reactor Core Isolation Cooling System
Components Subject to Aging Management Review
(Continued)

Component Type	Intended Function(s)
Tubing	Pressure boundary
Turbine casing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.2-6
Standby Gas Treatment System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary
Filter unit housing	Pressure boundary
Flexible connection	Pressure boundary
Flow element	Pressure boundary
Moisture separator housing	Pressure boundary
Piping	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Rupture disk	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.2-7
Primary Containment System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Flange	Pressure boundary
Flex hose	Pressure boundary
Flexible connection	Pressure boundary
Flow indicator	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.2-8-1
Residual Heat Removal System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.2-8-2
Core Spray System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

**Table 2.3.2-8-3
High Pressure Coolant Injection System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function[1]
Bolting	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Rupture disk	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.2-8-4
Reactor Core Isolation Cooling System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Flow indicator	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Rupture disk	Pressure boundary
Sight glass	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.2-8-5
Standby Gas Treatment System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.2-8-6
Primary Containment System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Damper housing	Pressure boundary
Flow element	Pressure boundary
Flow indicator	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Rupture disk	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

2.3.3 Auxiliary Systems

The following systems are described in this section.

- Section 2.3.3.1, Standby Liquid Control
- Section 2.3.3.2, Control Rod Drive
- Section 2.3.3.3, Service Water
- Section 2.3.3.4, Diesel Generator
- Section 2.3.3.5, Fuel Oil
- Section 2.3.3.6, Fire Protection – Water
- Section 2.3.3.7, Halon and CO_2
- Section 2.3.3.8, Heating, Ventilation and Air Conditioning
- Section 2.3.3.9, Fuel Pool Cooling and Cleanup
- Section 2.3.3.10, Instrument Air
- Section 2.3.3.11, Reactor Equipment Cooling
- Section 2.3.3.12, Plant Drains
- Section 2.3.3.13, Nitrogen
- Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

2.3.3.1 Standby Liquid Control

System Description

The purpose of the standby liquid control (SLC) system is to provide a backup system, independent of the control rods, which has the capability to bring the reactor from rated power to a cold shutdown condition. The SLC system is needed in the special event that not enough control rods can be inserted in the reactor core to accomplish shutdown and cooldown in the normal manner.

The SLC system consists of a storage tank, two positive displacement pumps, two explosive (squib) valves, a test tank, and associated piping and valves. The system, manually actuated from the control room, is designed to pump a boron solution into the reactor. The liquid is piped into the reactor vessel and discharged near the bottom of the core shroud so it mixes with the cooling water rising through the core. The boron absorbs thermal neutrons and thereby terminates the nuclear fission chain reaction in the uranium fuel.

The SLC system has the following intended functions for 10 CFR 54.4(a)(1).

- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment isolation.

The SLC system has the following intended functions for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The SLC system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for anticipated transient without scram (ATWS) (10 CFR 50.62).

USAR References

Section III-9

Components Subject to Aging Management Review

ASME Class 1 components with the intended function of maintaining the reactor coolant pressure boundary are reviewed with the RCS (Section 2.3.1.3). Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10

CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining SLC components are reviewed as listed below.

Table 2.3.3-1 lists the component types that require aging management review.

Table 3.3.2-1 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawing.

LRA-2045-SH02

2.3.3.2 Control Rod Drive

System Description

The purpose of the control rod drive (CRD) system is to provide reactivity control by positioning the control rods to control power generation in the core. The control rod drive system is designed to insert the control rods, when required, with sufficient speed to limit fuel barrier damage. The control rod drive system includes the control rod blades, the control rod drive mechanisms, and the components, piping and valves of the control rod drive hydraulic system.

The CRD mechanism used for positioning the control rod in the reactor core is a double-acting, mechanically latched, hydraulic cylinder. The individual drives are mounted on the bottom head of the reactor vessel, inside primary containment. The CRD housings are welded into the reactor vessel with their lower end terminating in a flange below the vessel to which the drive is bolted. The control rod drive hydraulic system hydraulically operates the CRD mechanisms using processed condensate water as hydraulic fluid. The CRD mechanisms operate manually to position the control rods but act automatically to rapidly insert the control rods during abnormal conditions requiring rapid shutdown.

The CRD hydraulic system supplies and controls the pressure and flow to and from the CRDs. One supply subsystem supplies water to the hydraulic control units (HCUs) at the correct flow. Each HCU controls the water flow to and from its associated CRD during normal operation (with and without CRD motion) and reactor scram. The water discharged from the 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 flows through its HCU and into the exhaust header.

Scram accumulators are provided to hold sufficient water volume and stored energy (nitrogen pressure) to fully insert the control rods independent of any other source of energy at low reactor vessel pressure. At higher reactor vessel pressures, CRD insertion is assisted on the upper end of the stroke by reactor vessel pressure acting on the drive via a ball check (shuttle) valve. Each accumulator consists of a water volume pressurized by nitrogen.

The alternate rod insertion (ARI) feature functions as a backup to the reactor protection system (RPS) scram and will only result in rod motion upon a failure of the RPS scram. ARI valves operate during an anticipated transient without scram (ATWS) event to depressurize the scram air header independently of the scram pilot valves and back-up scram valves.

The CRD hydraulic system can be used to provide makeup injection to the reactor vessel, but this function is not credited in the safety analyses and is not a safety function. The hydraulic system also supplies flow for the cold reference leg continuous backfill, to the reactor water cleanup (RWCU) system pump seals, and to the recirculation pump seals; these functions are not safety functions.

The CRD system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide a means to quickly terminate the nuclear fission process in the core to prevent fuel cladding failure and to prevent excessive nuclear system pressures.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment isolation.

The CRD system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CRD system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). Credited functions are performed by the control rods (shutdown function) and by the scram discharge volumes and their associated piping and valves, which are credited with collecting the water discharged from above the control rod drive pistons following a scram and containing the reactor water that leaks past the drive mechanisms following a scram.
- Perform a function that demonstrates compliance with the Commission's regulations for anticipated transient without scram (ATWS) (10 CFR 50.62) (ARI function).
- Perform a function that demonstrates compliance with the Commission's regulations for station blackout (SBO) (10 CFR 50.63) (normal scram function).

<u>USAR References</u>

Sections III-4.0 and III-5.0

<u>Components Subject to Aging Management Review</u>

The portions of the CRD housings that are welded to the reactor vessel, stub tubes, and the mechanism to housing bolts are reviewed with the reactor vessel (Section 2.3.1.1). The CRD guide tubes and other components internal to the reactor vessel are reviewed in with the reactor vessel internals (Section 2.3.1.2). The passive pressure boundary portions of the control rod drive unit as shown on USAR Figure III-5-4 and the ASME Class 1 CRD valves and piping that supply the reactor recirculation pumps (see LRA-2039) are included in the review of the reactor coolant pressure boundary (Section 2.3.1.3). Two valves associated with penetration leakage rate tests (Penetration X36) are reviewed with primary containment penetrations (Section 2.3.2.7). Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining CRD components (non-Class 1 safety-related piping and components in the CRD system code including the HCUs and piping and components to and from the control rod drives) are reviewed as listed below.

The control rod drive mechanisms are active components and therefore not subject to aging management review. The control rod blades are not subject to aging management review as they are periodically replaced on the basis of exposure and are therefore not long-lived components.

Table 2.3.3-2 lists the component types that require aging management review.

Table 3.3.2-2 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawing.

LRA-2039

2.3.3.3 Service Water

System Description

The purpose of the service water (SW) system is to provide a heat sink for the reactor equipment cooling (REC) system (Section 2.3.3.11), RHR system (Section 2.3.2.1), and diesel generator cooling systems (Section 2.3.3.4) under transient and accident conditions, and provide a heat sink for systems cooled by the REC and turbine equipment cooling (Section 2.3.3.14, TEC) systems during planned operations, as well as supplying the RHR service water (RHRSW) booster pumps during RHR system operation for shutdown cooling. The RHRSW booster pumps provide cooling to the RHR system. The booster pumps maintain SW pressure greater than RHR system pressure to prevent an uncontrolled release in the event of an RHR heat exchanger tube failure after a design basis event.

The SW system is normally operating. The system consists of four SW pumps supplying two seismic Class IS cooling water loops and one turbine building loop with associated strainers, piping, and valves. The system also includes the four (two per loop) RHRSW booster pumps and associated piping and valves. Each seismic Class IS loop feeds one diesel generator, two RHRSW booster pumps, and one REC heat exchanger. Either SW loop can supply normal cooling to the REC critical loads, the diesel generators, the RHRSW booster pump room fan coil unit, and the control room air conditioning unit. Automatic valving is provided to shut off supply to the non-essential service loop on low header pressure. Cooling water is pumped from the Missouri River. After completing the cycle through the loops, water is collected in two discharge headers and routed to the discharge canal, where the water is returned to the river.

The SW system supplies the following essential loads.

- RHRSW booster pumps
- REC heat exchanger
- strainer backwash
- diesel generator engine cooling
- service water gland water
- RHRSW booster pump gland water

The RHRSW booster pump gland water is normally supplied by the Class IIS Riverwell pumps in the circulating water (CW) system. If the Riverwell supply is unavailable, gland water is aligned to the essential supply, which is the discharge of the booster pumps.

Service water provides a backup cooling water source to the REC system critical cooling loads in the event of a passive failure in the REC system. The REC–service water intertie is also credited seven days after a Design Basis Accident (DBA) LOCA to ensure satisfactory room cooling for ECCS equipment for a 30-day event duration.

Service water is available as a backup supply to the control building basement fan coil unit (located in the RHRSW booster pump room) and to the control room air conditioning unit. These air conditioning units have been determined to be non-essential as required temperatures can be maintained without their operation.

In the event that the normal spent fuel makeup water sources are unavailable, service water can be used to supply the spent fuel pool through (1) the seismic Class II RHR-to-fuel pool intertie with water supplied by the RHR service water booster system, or (2) hoses attached to the reactor building service water drain connections on the RHR heat exchangers.

The SW system supplies the following non-essential loads.

- screen wash and sparger systems
- turbine equipment cooling
- circulating water fill system
- circulating water pump seals and spargers

Piping is provided from the RHRSW booster pumps to RHR piping for emergency core flooding in the event the engineered safeguards systems are inoperative during a LOCA. This capability is beyond the design basis of the plant and is therefore not a safety function.

The SW system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide cooling water to the REC heat exchangers, the RHR heat exchangers, and the diesel generator cooling systems.
- Provide emergency backup water to the REC system.
- Provide adequate pressure on the secondary side of the RHR heat exchangers to prevent an uncontrolled release of radioactive material to the environment (function performed by the RHRSW booster pumps).

The SW system has the following intended function for 10 CFR 54.4(a)(2).

- Provide makeup water to the spent fuel pool.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The SW system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48) (provide cooling water to the REC heat exchangers, the RHR heat exchangers, and the diesel generator cooling systems).

USAR References

Section X-8.0 and X-3.6.3 (makeup to spent fuel pool)

Components Subject to Aging Management Review

Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining SW components are reviewed as listed below.

Hoses used for spent fuel makeup are not subject to aging management review as they are periodically inspected and replaced based on condition.

Table 2.3.3-3 lists the component types that require aging management review.

Table 3.3.2-3 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2006-SH01	LRA-2007
LRA-2006-SH02	LRA-2036-SH01
LRA-2006-SH03	LRA-2036-SH02
LRA-2006-SH04	LRA-2077
LRA-2006-SH05	LRA-KSV-47-8

2.3.3.4 Diesel Generator

System Description

The purpose of the diesel generator (DG) system is to provide a single-failure-proof source of on-site AC power adequate to safely shut down the reactor, maintain the safe shutdown condition, and operate auxiliaries necessary for station safety following abnormal operational transients and postulated accidents. The DG system consists of two independent diesel generators, each with its supporting auxiliary systems, which are separate system codes in the component database: diesel generator fuel oil (reviewed in Section 2.3.3.5), diesel generator jacket water (DGJW), diesel generator lube oil (DGLO), and diesel generator starting air (DGSA).

Each diesel generator is dedicated to a critical bus. A DG starts automatically on a loss of coolant accident (LOCA) signal (i.e., low reactor water level signal or high drywell pressure signal) or on a critical bus degraded voltage or undervoltage signal. After the DG has started, it automatically ties to its respective bus after offsite power is tripped as a consequence of critical bus undervoltage or degraded voltage, independent of or coincident with a LOCA signal. The DGs also start and operate in the standby mode without tying to the critical bus on a LOCA signal alone. Following the trip of offsite power, all loads are shed from the critical bus. When the DG is tied to the critical bus, loads are then sequentially connected to its respective critical bus. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG.

Each DG unit is housed in a reinforced concrete seismic Class I structure. Either DG is capable of starting and continuously operating under postulated accident conditions for a period of seven days using fuel stored on site in underground storage tanks.

Each engine has a combustion air intake system to provide combustion air for the operation of the DG. The intake air system consists of an air filter and 24-inch diameter steel pipe to direct the air from the filter to the compressor inlet port of the turbocharger. Intake air is drawn from outside the building through an opening fitted with a louver and bars to provide intrusion protection. Each engine has an exhaust system to provide a flow path for the engine exhaust from the engine to the exterior of the diesel generator building. Diesel exhaust flows from the engine through the turbine section of the turbocharger, then simultaneously to the silencer (muffler) bypass and to the silencer (muffler) and stack located on the diesel generator building roof, next to the turbine building. Piping is equipped with expansion joints to compensate for the wide range of temperatures the piping experiences during operation.

The DG system has the following intended function for 10 CFR 54.4(a)(1).

- Provide a single-failure proof supply of on-site AC power adequate for the safe shutdown of the reactor.

The DG system has no intended functions for 10 CFR 54.4(a)(2).

The DG system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

Diesel Generator Jacket Water System

The purpose of the DGJW system is to provide sufficient cooling water to the diesel engine under all conditions. The system is a closed recirculating-water circuit that circulates treated (demineralized) water for engine cooling. The system also maintains the DG cylinder temperatures above 100°F during standby conditions.

The DGJW system for each DG consists of a 385-gallon standpipe, an engine driven pump, a heat exchanger, a bypass pump, and associated piping and valves. The engine-driven pump takes suction from the standpipe and circulates the jacket water through a thermostat-controlled valve, the jacket water heat exchanger (which uses service water as the heat sink), through the engine, and back to the standpipe.

The bypass pump takes a suction from the standpipe, circulates jacket water through an in-line electric heater, and through the engine. This circuit is intended to maintain the jacket water at a temperature of about 120°F, which will promote rapid starting of the diesel. This function is not a safety function.

The DGJW system has the following intended function for 10 CFR 54.4(a)(1).

- Transfer heat from the DG cylinders to the service water system via the jacket water heat exchanger.

The DGJW system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The DGJW system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

<u>Diesel Generator Lube Oil</u>

The purpose of the DGLO system is to circulate oil through the engine to lubricate and cool the moving parts for the diesels under all conditions. The DGLO system provides oil flow during engine operation, engine starts and stops, and standby conditions.

The DGLO system consists of a engine-driven pump, bypass pump, pre-post lube oil pump, filters, strainers, oil cooler, heater, and external and internal lube oil circuits. In the main lube oil circuit, the engine-driven pump takes suction from the engine sump and circulates lube oil through a thermostat-controlled three-way valve, lube oil heat exchanger, full-flow filter and a strainer back to the oil header of the engine.

The bypass circuit maintains the lube oil at a minimum temperature. The pre-post lube oil pump is used to circulate oil before a manual start and to continue oil circulation when the DG is stopping. These functions are not safety functions.

The DGLO system has the following intended function for 10 CFR 54.4(a)(1).

- Provide lubrication and lube oil cooling during DG operation.

The DGLO system has no intended functions for 10 CFR 54.4(a)(2).

The DGLO system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

<u>Diesel Generator Starting Air</u>

The purpose of the DGSA system is to store and provide compressed air to start the DG. The system also operates safety shutdown trips to protect the DG during surveillance test runs and provides a means to position the engine for maintenance work.

The DGSA consists of redundant AC motor-driven air compressors (one of which can be driven by a connected diesel), redundant air receiver tanks, and associated piping, valves, and moisture separators necessary to supply air to the air-over-cylinder starting mechanism. Each DG has its own DGSA system, and the systems can be cross-tied through normally closed isolation valves to increase the level of redundancy and reliability. Each receiver has adequate capacity for multiple start attempts on the DG without recharging the air start receiver.

The DGSA system has the following intended function for 10 CFR 54.4(a)(1).

- Provide compressed starting air for the DGs.

The DGSA system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The DGSA system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

USAR References

DG: Section VIII-5.0

DGJW: Section X-8.1.5 (contains description of service water flow to jacket water heat exchanger)

DGLO: Section X-8.1.5 (contains description of service water flow to lube oil cooler)

DGSA: Section VIII-5.3.3

Components Subject to Aging Management Review

Components in the DG and DGLO systems are reviewed as listed below.

Nonsafety-related components of the DGJW and DGSA systems whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining DGJW and DGSA systems components are reviewed as listed below.

Table 2.3.3-4 lists the component types that require aging management review.

Table 3.3.2-4 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-KSV-46-5

LRA-KSV-47-8

LRA-DG-JW

LRA-KSV-96-3

LRA-2077

2.3.3.5 Fuel Oil

System Description

The review of fuel oil systems encompasses the diesel generator fuel oil system (DGDO) and fuel oil portion of the fire protection (FP) system.

Diesel Generator Fuel Oil System

The purpose of the DGDO system is to provide for the storage and transfer of clean fuel oil for the diesel generators.

The DGDO system includes two nominal 30,000-gallon underground storage tanks, each with its own transfer pump and piping connections to its respective fuel oil day tank. Cross-ties are provided such that either DG can be supplied from either diesel oil storage tank. Both diesel oil storage tanks combined contain sufficient fuel for seven days' operation of one DG at its rated continuous load. The outside tanks, pumps and piping are located underground. Each day tank has sufficient capacity for a minimum of five hours of operation at full load for its respective DG.

An engine-driven fuel pump for each diesel takes a suction on the day tank through a suction strainer and delivers fuel oil through a fuel oil filter to the fuel injection system of the engine. A DC booster pump is available for engine startup and in the event of failure or malfunction of the engine-driven pump.

The DGDO system has the following intended functions for 10 CFR 54.4(a)(1).

- Store and transfer clean fuel oil for use by the DGs.
- Provide pressurized fuel from day tanks to the DG fuel injector nozzles.

The DGDO system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The DGDO system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Fire Protection System Fuel Oil Components

The purpose of the fire protection (FP) system is to provide adequate fire protection capability to the station. Only FP system components exposed to fuel oil are reviewed in this section. The remainder of the FP system is reviewed in Section 2.3.3.6, Fire Protection – Water and Section 2.3.3.7, Halon and CO2.

The diesel fire pump is provided with a fuel oil storage tank and the necessary components to transfer fuel oil from the tank to the diesel.

USAR References

Section VIII-5.0 (The USAR does not describe the diesel fire pump fuel oil supply.)

Components Subject to Aging Management Review

Nonsafety-related fuel oil components whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining fuel oil components are reviewed as listed below.

Table 2.3.3-5 lists the component types that require aging management review.

Table 3.3.2-5 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2011-SH01
LRA-2016-SH02
LRA-2077

2.3.3.6 Fire Protection – Water

The purpose of the fire protection (FP) system is to provide adequate fire protection capability to the station. The FP – water system is a subsystem of the FP system code in the component database but is described as a separate system. Halon components of the FP system code are reviewed in Section 2.3.3.7 with the carbon dioxide system, as are portable fire extinguishers and portable breathing apparatus.

Other components of the fire protection program are reviewed elsewhere: smoke and heat ventilation systems with the heating and ventilation systems (Section 2.3.3.8), detectors with the EIC evaluation, and fire barriers and fire stops with structural reviews. Fuel oil components associated with the diesel fire pump are reviewed in Section 2.3.3.5, Fuel Oil.

<u>System Description</u>

The FP – water system includes two water storage tanks, one diesel-driven 3000 gpm fire pump, one electric-driven 3000 gpm fire pump, one electric-driven 2000 gpm fire pump, one 30 gpm jockey fire pump, fire water yard mains, hydrants, standpipes, hose stations, sprinklers, and deluge spray systems.

Two above-ground fire protection water storage tanks, each having a gross capacity of 500,000 gallons of water, provide the dedicated water supply for fire protection use. The storage tanks are located inside the security fence on the north side of the plant. The tanks supply water to two fire pumps located in the fire pump house, one electric-driven and one diesel-driven. A third fire pump takes suction directly from the Missouri River and provides a backup supply to the system. This pump is located in the intake structure. A jockey pump located in the fire pump house provides routine make-up water to the distribution piping network.

Each water storage tank has a circulating pump and heater to provide protection from freezing of the water in the tank.

An outside 12-inch underground yard loop surrounds the station and provides water to hydrants, wet standpipes, hose stations, deluge spray systems, and sprinkler systems. Hydrants with two gated discharge ports are provided on the yard main at approximately 250 foot intervals. Fire hydrants are provided with an isolation valve in order to isolate the hydrant in the event of physical damage or mechanical malfunction.

As an alternate supply of makeup water, the spent fuel pool can be supplied with water from fire hoses using hose valves.

The FP – water system has no intended functions for 10 CFR 54.4(a)(1).

The FP – water system has the following intended function for 10 CFR 54.4(a)(2).

- Provide back-up water supply to the spent fuel pool.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The FP – water system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform functions that demonstrate compliance with the Commission's regulations for fire protection (10 CFR 50.48).
    - Provide the capability to extinguish fires in vital areas of the plant.
    - Provide a source of water to fixed fire suppression systems, hydrants, and standpipe hose stations as credited in the Appendix R fire hazards analysis.
    - Provide fire extinguishment by fixed fire suppression water systems in areas credited in the Appendix R fire hazards analysis.

USAR References

Section X-9.0, X-18.0

Components Subject to Aging Management Review

Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining FP – water components are reviewed as listed below.

Table 2.3.3-6 lists the component types that require aging management review.

Table 3.3.2-6 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2006-SH01	LRA-2016-SH02
LRA-2016-SH01	LRA-2016-SH03
LRA-2016-SH01A	LRA-2016-SH06
LRA-2016-SH01B	LRA-2037
LRA-2016-SH01C	LRA-2081

2.3.3.7 Halon and CO_2

The purpose of the fire protection (FP) system is to provide adequate fire protection capability to the station. Halon components of the FP system code are reviewed in this section with the CO_2 system code. Portable fire extinguishers and portable breathing apparatus are included in this review. For the review of other FP system components, see Section 2.3.3.6, Fire Protection – Water.

<u>System Description</u>

<u>Halon</u>

The FP system includes two Halon systems, one each for the service water pump room and the computer room in the control building. The service water pump room is protected with an automatic Halon 1301 total flooding system with a design concentration of eight percent. The computer room has a total flooding Halon 1301 system with a design concentration of six percent. Both systems are designed with a reserve tank for back-up; however, the computer room is not required for safe shutdown and its Halon system has no intended function for license renewal. The fire brigade response and manual fire fighting with portable extinguishers and hose stations are credited with controlling fires in the computer room; the Halon 1301 system is provided only to limit damage to the computer room.

The Halon system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The Halon system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (provide the capability to extinguish fires in the service water pump room).

<u>CO_2</u>

The purpose of the carbon dioxide (CO_2) system is to provide fire suppression capability to each diesel generator room and to various areas through hand hose stations.

Carbon dioxide for fire protection is stored in a low-pressure bulk storage tank. The tank supplies protection for the turbine bearing areas in proximity to high-temperature turbine parts and provides CO_2 for the hand hose stations. A separate high-pressure CO_2 fire protection system is provided for each diesel generator.

The storage tank connects to a pipe distribution system that delivers CO_2 to the following areas.

- generator purge
- high pressure turbine bearings

- hand hose stations
    - control room entrance
    - cable spreading room
    - non-critical switchgear area
    - motor-generator set in the reactor building

The CO_2 system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The CO_2 system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (provide the capability to extinguish fires in the diesel generator rooms and provide for manual fire suppression using hand hose stations as credited in the Appendix R fire hazards analysis).

USAR References

CO_2: Section X-9.3.2.5

Halon: Section X-9.3.2.6

Components Subject to Aging Management Review

Halon and CO_2 components are reviewed as listed below.

Table 2.3.3-7 lists the component types that require aging management review.

Table 3.3.2-7 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2016-SH04
LRA-2016-SH04A

2.3.3.8 Heating, Ventilation and Air Conditioning

System Description

The purpose of the heating and ventilation (HV) system is to provide individual air supplies to the areas of the station that may be occupied by personnel or that contain temperature sensitive equipment.

Exhaust from areas where potentially radioactive gases may be present is not recirculated but is separated from non-radioactive effluents and monitored for radiation level prior to discharge. Non-radioactive air is discharged to the outside atmosphere from roof vents or wall louvers near roof level. Normal airflow is routed from lesser to progressively greater areas of radioactive contamination potential prior to final exhaust.

The HV system includes the following subsystems.

Reactor Building Heating, Ventilation and Air Conditioning (HVAC)

The reactor building heating and ventilating system provides adequate area cooling to support ECCS pump operation for credited events and minimizes the unfiltered release of radioactive materials. The system controls the reactor building air temperatures and the flow of airborne radioactive contaminants to support the function of equipment and the accessibility and habitability of the reactor building. The reactor building consists of the primary containment area (drywell and pressure suppression chamber), the secondary containment area that surrounds the primary containment area, and various rooms housing equipment and/or processes which require separate ventilation treatment, as described below. Reactor building HVAC performs the safety function of maintaining secondary containment when required by closing dampers in the supply and exhaust ducts.

The reactor building heating and ventilating system monitors the reactor building exhaust plenum and isolates the system upon detection of high radiation levels. This function is provided by gamma detectors that are mounted such that they can monitor the radiation levels in the flow of gas through the reactor building plenum.

The following systems are part of the reactor building HVAC.

Primary Containment HVAC

The drywell portion of the primary containment is cooled by four water-cooled fan-coil units located inside the drywell, recirculating the contained air and/or nitrogen volume. The system is designed to limit the average air/nitrogen temperature to 135°F during reactor normal operation and to provide cool-down capability after reactor shutdown. The system consists of four fan-coil units, dampers, and ductwork. The system is not required to be in operation during design basis accidents or for any of the regulated events.

Secondary Containment Ventilation

The secondary containment area (most of the reactor building) has normal supply and exhaust ventilating systems.

The supply system furnishes filtered outdoor air to all floors of the building through ductwork. The supply system heating and ventilating unit consists of a manually advanced filter, a heating coil, and duplex fans. The supply unit has an operating and standby fan with vortex dampers to provide regulation of air capacity. During normal plant operation, a minimum average negative pressure of 0.25 inches (w.g.) is maintained. The fans will deenergize in the event of loss of offsite power. A heating coil is provided to heat the outside supply air when necessary with station heating steam.

During normal plant operation, exhaust air is induced from the ventilated areas to a common plenum connected to two exhaust fans, each of 100% capacity. The air is then exhausted to the atmosphere through a long duct run. This long duct provides hold-up time to minimize the release of radioactive material to atmosphere during the time required for the signal from the radiation monitors to actuate the exhaust valves to full closure position.

The normal ventilation system is not required to be in operation during design basis accidents or for any of the regulated events. However, if a fuel handling accident or loss of coolant accident should occur, the system has the safety function of automatically isolating ventilation systems to maintain secondary containment.

Below Grade Areas

The reactor building heating and ventilation system provides normal ventilation to support normal plant operation and also performs the safety function of providing adequate area cooling to support ECCS pump operation for credited events.

In the four quads, ventilation air is provided individually to each room (two core spray pump rooms and two RHR pump rooms). Air then flows through wall penetrations to the suppression chamber area where it enters exhaust ducts to the main exhaust system. This portion of the system is not required to be in operation during design basis accidents or for any of the regulated events.

To prevent overheating of pump motors due to possible high room temperatures during periods of emergency operation, water-cooled recirculation fan coil units are provided to maintain quad temperatures within design temperature limits. The fan coil unit motors are powered from critical buses and the cooling coils are cooled by the reactor equipment cooling (REC) system. The fan coil units automatically start on actuation of their associated ECCS pumps.

During certain accident scenarios, the northwest and southwest (RHR) quads may lose fan coil unit cooling. Under these conditions, adequate natural convection cooling is available through gratings for continuous operation of a single RHR pump in each quad.

Ventilation air from the normal reactor building ventilation is also supplied to the HPCI room; however, this is not credited for emergency equipment operation. The HPCI room fan coil unit is a safety-related cooling unit that is interlocked to run continuously with the HPCI turbine. The fan motor for this unit is powered from a critical bus and cooling water is supplied by REC. The fan coil unit is designed to limit the maximum average HPCI room temperature to 135°F during HPCI operation.

Potentially Contaminated Areas

For areas or rooms with a high potential of contamination, the exhaust air is first passed through banks of prefilters and HEPA filters before discharging into the main exhaust system. These rooms are the RWCU system sludge tank cell, the RWCU recirculating pump rooms, RWCU regenerative heat exchanger room, phase separator tank room, and RWCU filter demineralizer rooms. These components are not required to be in operation during design basis accidents or for any of the regulated events.

Exhaust fume hoods in the reactor building include ducting through individual booster fans and filters, which maintains a negative pressure at potentially contaminated areas and filters air prior to discharge through the main reactor building exhaust plenum. The walls of the spent fuel pool, reactor cavity, and dryer/separator storage pit contain multiple openings in their sides just above water level (when flooded up) for embedded exhaust ducts. Part of the ventilation air supplied to the refueling floor is drawn through these ducts, discharging to the monitored common exhaust plenum. During normal conditions, this airflow effectively prevents the spread of airborne contamination from these areas to other parts of the refueling floor that are of lower contamination potential. These components are not required to be in operation during design basis accidents or for any of the regulated events.

Motor-Generator Sets Ventilation

The two reactor recirculation system motor-generator sets have their own common ventilation system. Outside air is induced through weatherproof louvers into an intake area and through a bank of roughing filters via separate ductwork and shutoff (isolation) valves to the casing of each motor-generator set. The exhaust is through separate ducts and shutoff isolation valves to a fan room. Two exhaust fans, each of 100%

capacity (one operating, one spare), convey the air through ductwork and an exhaust stack to atmosphere. Although the system is not required to be in operation during design basis accidents or for any of the regulated events, this system is credited with isolation to maintain reactor building integrity.

Miscellaneous Area Cooling

The steam tunnel is cooled by two fan coil units located in the steam tunnel. The fan coil units are manually controlled from the main control room. They are powered from non-critical buses and supplied with cooling water from the TEC system. The system is not required to be in operation during design basis accidents or for any of the regulated events.

The alternate shutdown room has an air conditioning unit that consists of a fan coil unit (including a duct heater), a condenser, and a humidity controller unit. The unit is thermostatically controlled from inside the room to maintain temperature and humidity for personnel comfort. The system is not required to be in operation during design basis accidents or for any of the regulated events.

Control Building HVAC

The control building heating and ventilating system supplies filtered and tempered air to the control building except for the main control room, computer room, and cable spreading room. The system provides temperature controls to critical electrical heat loads and prevents an explosive accumulation of hydrogen from the station batteries. The system includes non-essential HVAC and essential HVAC.

Essential HVAC is provided by a network of safety-related supply and exhaust fans that perform the safety functions of cooling the critical AC switchgear rooms and DC switchgear and preventing hydrogen buildup in the battery rooms during abnormal and accident conditions. The system consists of two redundant trains, each consisting of a 100 percent capacity supply fan and a 100 percent capacity exhaust fan, to remove the heat generated by the essential electrical equipment. The essential system provides adequate air movement to eliminate the accumulation of an explosive mixture of hydrogen in the battery rooms. Dampers are located in air ducts to provide necessary isolation during non-essential or essential system operation, to preclude recirculation of air in the system, to stop air flow to the battery rooms under low temperature conditions, and to preclude the spread of fire between switchgear rooms.

Non-essential control building HVAC consists of one heating and ventilating unit, one backup fan coil unit to cool the RHR service water booster pump room, two battery room exhaust fans, and two recirculation fans that exhaust to atmosphere or back to the system inlet. The battery room exhaust fans provide for dilution and removal of potentially flammable concentrations of hydrogen in the battery rooms. The recirculation fans provide pressure control by recirculating the return air or discharging this air to atmosphere during periods of suitable outside air temperature for cooling requirements. Non-essential fans trip when the essential control building ventilating system starts.

The backup fan coil unit located in the RHR service water booster pump room starts automatically on high temperature and serves as a backup to the control building heating and ventilating system in providing normal room cooling. Acceptable room temperatures can be maintained for a single RHR service water booster pump without forced ventilation through operator action to reduce the room heat load and establish a natural ventilation flowpath. Therefore, this part of the ventilation system is not required to be in operation during design basis accidents or for any of the regulated events.

Main Control Room Air Conditioning System

The main control room air conditioning system, including the control room emergency filter (CREF) system, assures continuous occupancy of the control room emergency zone during credited plant events. The emergency zone consists of the control room proper (including the kitchen and toilet facilities) and access area around the main control room. The area serviced by the main control room air conditioning system includes the cable spreading room below the main control room.

The main control room is air conditioned by its own package-type self-contained air conditioning unit system, complete with filters, cooling coils, heating coils, two supply fans (one operating, one 100% spare), compressor-condenser unit, automatic dampers, controls, and ductwork. The refrigeration cycle condenser water requirements can be manually transferred from the turbine equipment cooling system to the service water system; however, this cooling function is not a safety function.

The control room envelope (CRE), which includes the control and cable spreading rooms, is positively pressurized to minimize unfiltered leakage from all adjoining areas into the CRE. Normally open Class I fire/smoke dampers are installed in the floor between the control room and cable spreading room to equalize pressure between the two rooms. These fire/smoke dampers are designed to remain open during a design basis event but automatically shut in the event of fire or smoke in the cable spreading room. The control room ventilation system contains a smoke detector in the return air duct from the cable spreading room that is interlocked to shut fire/smoke dampers, to shut down the supply air system, and to actuate an alarm in the control room.

Control Room Emergency Filter System

The CREF system provides a radiologically controlled environment from which the unit can be safely operated following a design basis accident. The system consists of a prefilter, a high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section, a supply fan, an emergency booster fan, an exhaust booster fan, and the associated ductwork and dampers. Prefilters and HEPA filters remove particulate matter, which may be radioactive. The charcoal adsorbers provide a holdup period for gaseous iodine, allowing time for decay.

The CREF system is a standby system. Upon receipt of the initiation signal(s) (indicative of conditions that could result in radiation exposure to control room personnel), the CREF system automatically switches to the emergency bypass pressurization mode of operation to minimize infiltration of contaminated air into the control room. A system of dampers isolates the normal outside air intake and routes outside air through the filter system. Outside air is taken in at the normal ventilation intake and is mixed with recirculated air after being passed through the filter unit for removal of airborne radioactive particles.

Diesel Generator HVAC

The diesel generator HVAC system has the safety function of providing heat and ventilation for the diesel generators. The two heating and ventilating units for each room maintain conditions during two modes of operation: one small unit with no diesel generator unit operating and the second larger unit during diesel generator operation cycle. The small heating and ventilating unit normally operates continuously. The large unit and the exhaust fan are energized when the diesel generator unit is operated. The exhaust fan, with ductwork, discharges the hot air to the atmosphere.

Fan failure is annunciated in the control room. The system will maintain the diesel generator room environments within a nominal maximum temperature range of 120°F to 137°F.

Turbine Building HVAC

The turbine building ventilating systems supply filtered air to all areas of the turbine building. This air is routed to areas of progressively greater radioactive contamination potential prior to final exhaust. The system is not required to be in operation during design basis accidents or for any of the regulated events.

Three heating and ventilating units, through distribution ductwork, send 100% outside air to all areas of the turbine building outside of the shielded spaces. Air from the non-radiation potential areas, if not induced directly into shielded rooms, flows up to the operating floor level via hatches and stairwells. It is induced over the shielded walls in the operating floor, flowing downward to the basement through a concrete plenum labyrinth to the exhaust fans. Four exhaust fans are located in the fan room adjacent to the turbine building. Exhaust air is discharged to the atmosphere above the roof of the fan room. A differential pressure controller maintains a minimum negative pressure of 0.25 inches (w.g.) by controlling the fan vortex dampers.

Two fans, one operating and one spare, draw air over the turbine-generator set into duct work, then discharge to the heater bay where it is induced into the exhaust duct work. The non-critical switchgear room is independently temperature controlled with a rooftop-mounted package air conditioning unit capable of supporting the cooling load generated within the room. The electric shop is independently temperature controlled with an air handling unit mounted above the suspended ceiling capable of supporting the cooling load generated within the room. Rooms or areas employing oil or other combustible materials have fire dampers in the ventilation system.

Intake Structure HVAC

The intake structure is comprised of two areas: the service water pump room and the intake structure main area. The service water pump room is a missile-protected room having two fan coil units and the general area is served by unit heaters and roof ventilation. All fans are manually started and powered from non-critical buses.

For the service water pump room, two fan coil units operate together. Each contains a filter, cooling coil, heater coil, and fan in a sheet metal casing. Both units are controlled by room thermostats regulating freon or steam to the coils control valves. The units bring in sufficient outside air for habitability purposes, and the resulting excess room air is forced through relief openings to the main room for eventual exhaust. No service water pump room HVAC equipment is credited for service water pump operation (see USAR Section X-8.1.6).

The service water pump room is protected by an automatic Halon 1301 total flooding system that closes ventilation dampers upon actuation. These dampers perform an intended function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

For the intake structure main area, seven unit heaters provide steam heated air to maintain the building at a minimum of 50°F temperature. Steam is passed through coils with heater fans controlled by area thermostats. Eight roof ventilators induce outside air through wall louvers (dampers manually operated) and are spaced to provide complete air movement throughout the building before exhausting to atmosphere. These components are not required to be in operation during design basis accidents or for any of the regulated events.

Fire Pump House HVAC System

The HVAC system in the fire pump house consists of three separate systems, one for each room required. The diesel fire pump room HVAC has two roof-mounted fans, louvers, space heaters, and thermostats. The electric fire pump room has a roof-mounted fan with louvers, a space heater, and thermostats. The diesel fuel oil day tank room HVAC consists of a roof-mounted fan, louvers, a space heater and a thermostat. This equipment is required to cool fire protection system equipment and therefore performs a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

Temporary Ventilation

Temporary ventilation is available on site for use in certain areas, such as switchgear rooms, if normal ventilation is not available after a fire. The equipment consists of portable exhaust ventilation units and suitable ducting. This equipment performs a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

The remaining plant heating and ventilation equipment consists of the following systems that are not required to be in operation during design basis accidents or for any of the regulated events.

- HVAC hot water
- HVAC chilled water
- Radwaste building HVAC
- Augmented radwaste building HVAC
- Office building HVAC
- Control corridor area heating and ventilating
- Miscellaneous HVAC systems
  - Maintenance lunch room (machine shop building)
  - Radiochemistry laboratory, counting room, sampling room, corridor B202 and office
  - Radwaste control room (radwaste building)
  - Cable expansion room (control corridor)
  - Alternate operations support center (instrument shop, adjacent rooms) located in the turbine building
  - Off-gas and auxiliary control rooms (augmented radwaste building)
  - Radioactive laundry
- Computer room air conditioning system
- Heating boiler room HVAC
- Turbine building exhaust fan room HVAC
- Water treatment room HVAC
- Machine shop HVAC
- Off gas building HVAC
- Multi-purpose facility HVAC
- Optimum water chemistry gas generator
- Railroad airlock HVAC
- PMIS battery room HVAC equipment

The HV system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide adequate area cooling to support ECCS pump operation for credited events (reactor building HVAC).
- Maintain secondary containment to minimize the unfiltered release of radioactive materials (reactor building HVAC).
- Provide temperature controls to critical electrical heat loads (control building HVAC).

- Prevent an explosive accumulation of hydrogen from the station batteries (control building HVAC).
- Assure continuous occupancy of the control room during credited plant events (CREF system).
- Provide ambient heat removal whenever the diesel generators are performing their safety function (diesel generator building HVAC).

The HV system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The HV system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform functions that demonstrate compliance with the Commission’s regulations for fire protection (10 CFR 50.48).
  - Provide ambient heat removal whenever the fire pumps are performing their intended function.
  - Provide ventilation for diesel generators (diesel generator HVAC), core spray pump rooms (below grade reactor building HVAC), the HPCI room (HPCI room ventilation), and battery rooms and critical switchgear rooms (essential control building HVAC).
  - Provide pressure boundary for Halon and CO_2 fire protection system actuations.
  - Provide fire damper housings mounted in ductwork, which are credited for fire protection.
  - Provide portable ventilation that is credited for use in certain areas (e.g., switchgear rooms) if normal ventilation is not available after a fire.

USAR References

Section X-10

Components Subject to Aging Management Review

Certain HV components associated with instrument air are reviewed with the instrument air system (Section 2.3.3.10). A damper housing for the SGT supply is reviewed with the standby gas treatment system (Section 2.3.2.6). Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining HV system components are reviewed as listed below.

Table 2.3.3-8 lists the component types that require aging management review.

Table 3.3.2-8 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2018

LRA-2019-SH01

LRA-2020

LRA-2024-SH02

LRA-2031-SH02

2.3.3.9 Fuel Pool Cooling and Cleanup

<u>System Description</u>

The review of the spent fuel pool cooling and cleanup (FPC) system includes the spent fuel pool storage racks and the Boral and Metamic™ poison curtains, which are components in the tools and servicing equipment (TSE) system code.

<u>Fuel Pool Cooling and Cleanup</u>

The purpose of the FPC system is to remove the decay heat released from the spent fuel assemblies. The system maintains a specified spent fuel pool water temperature, purity, water clarity, and water level.

The system cools the fuel storage pool by transferring the spent fuel decay heat through a heat exchanger to the reactor equipment cooling (REC) system. Filtering and demineralizing the pool water through a filter-demineralizer maintains water purity and clarity in the storage pool during normal operations, or the storage pool, reactor cavity, and dryer-separator storage pit during refueling operations.

The system consists of two parallel trains, each consisting of a circulating pump, heat exchanger, filter-demineralizer, and the required piping, valves, and instrumentation. The pumps circulate the pool water in a closed loop, taking suction from the skimmer surge tanks, circulating the water through the heat exchangers and filters, and discharging it through diffusers at the bottom of the fuel pool. This results in spent fuel pool water overflow via the skimmer wells back to the skimmer surge tanks. Check valves and siphon breaker holes prevent siphon backflow through the fuel pool cooling system discharge pipes. During refueling operations, the fuel pool cooling system suction and discharge paths can be aligned to the reactor cavity.

The spent fuel pool make-up is normally supplied from the seismic Class II condensate transfer system. Alternate seismic Class II sources of makeup are available via the RHR system or from fire hoses. In the event that the seismic Class II makeup sources are not available, service water can be supplied to the fuel pool through hoses attached to the reactor building service water drain connections on the RHR heat exchangers for long-term makeup.

A loop seal in the seal rupture drain line in fuel pool cooling piping is required to maintain secondary containment.

The FPC system has no intended functions for 10 CFR 54.4(a)(1).

The FPC system has the following intended functions for 10 CFR 54.4(a)(2).

- Maintain secondary containment integrity with loop seals in drains.

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The FPC system has no intended functions for 10 CFR 54.4(a)(3).

Tools and Servicing Equipment

The purpose of the tools and servicing equipment (TSE) system is to provide servicing equipment for various areas, such as the reactor vessel, fuel handling, fuel and control rod storage, in-vessel and under-vessel servicing, and CRD hydraulic servicing.

The TSE system includes the spent fuel storage racks. The spent fuel pool concrete structure, metal liner, and spent fuel storage racks are designed as seismic Class I. The original storage rack design consists of upper and lower "egg crate" grid structures, which retain the square aluminum cells and the nonstructural Boral poison curtains, provided for criticality control. Two new racks provide criticality control using Metamic™ neutron absorber plates.

The review of the Boral and Metamic™ poison curtains is included in this mechanical systems evaluation. The TSE system contains no other mechanical components with an intended function. Spent fuel pool structures, including the storage racks, are included in the structural evaluations.

The TSE system has the following intended function for 10 CFR 54.4(a)(1).

- Provide criticality protection. This function is performed by Boral and Metamic™ neutron absorption plates in the pool racks.

The TSE system has no intended functions for 10 CFR 54.4(a)(2) or (a)(3).

USAR References

Sections X-5.0, 3.5.1, 3.6.2; Sections X-3.0 (spent fuel storage racks) and X-4.0 (fuel handling equipment).

Components Subject to Aging Management Review

The loop seal in the seal rupture drain line (fuel pool cooling piping), required to maintain integrity of the secondary containment, is reviewed with plant drains (Section 2.3.3.12). Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). The remaining components in the fuel pool cooling (FPC) system are not reviewed in this section because they have no intended function for

10 CFR 54.4(a)(1) or (a)(3). As a result only TSE system components are included in this review.

Table 2.3.3-9 lists the component types that require aging management review.

Table 3.3.2-9 provides the results of the aging management review.

License Renewal Drawings

There are no drawings associated with the Boral and Metamic™ neutron absorption plates.

2.3.3.10 Instrument Air

System Description

This review includes both the instrument air system code (IA) and the service air system code (SA).

Instrument Air

The purpose of the instrument air (IA) system is provide the station with a continuous supply of dry, filtered air to critical pneumatic control systems and instruments as required to support the function of the system or instrument.

The IA system receives its air supply from the service air system air receivers. Two sets of air dryers are located in the instrument air line. Air filters before and after each set of air dryers provide high quality dry air to the non-critical instrument air headers (which supply non-critical instrumentation and control equipment) and to the reliable air header (which supplies the critical instrumentation and control equipment). When primary containment has been inerted with nitrogen, the reliable instrument air header is isolated from loads inside primary containment. Loads inside primary containment are then provided with nitrogen supplied by the nitrogen system (Section 2.3.3.13) with the reliable instrument air header available as a backup.

The IA system includes accumulators for the following to assure proper valve operation during a loss of instrument air:

- main steam line isolation valves (MSIVs),
- main steam safety relief valves (SRVs),
- drywell equipment drain sump pump discharge isolation valves,
- drywell floor drain sump pump discharge isolation valves,
- secondary containment ventilation isolation system valves,
- control room ventilation isolation valve,
- motor-generator (MG) set ventilation isolation valves, and
- reactor building-to-suppression chamber vacuum breakers.

The automatic depressurization system (ADS) uses six SRVs to reduce RCS pressure as required. These SRVs are equipped with accumulators to actuate the valves in the event that the normal pneumatic supply (nitrogen or air) fails.

The IA system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide a reserve capacity of compressed air (accumulators) for those components requiring a supply of compressed air to provide engineered safety features and reactor protection functions in the event of air system failure.

- Support primary containment isolation.

The IA system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The IA system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48) (function performed by the accumulators).
- Perform a function that demonstrates compliance with the Commission’s regulations for station blackout (10 CFR 50.63) (function performed by MSIV and SRV accumulators).

Service Air

The purpose of the service air (SA) system is to provide a continuous supply of oil-free compressed air for air-operated equipment and general station services.

The air supply is developed by three air compressors operating in parallel. Each compressor has an aftercooler and discharges to a common header. The discharge header supplies two air receivers, which have a common discharge that supplies both service air and instrument air. Service air is distributed throughout the plant by service air headers supplying various air operated equipment and service air hose stations. The SA system includes primary containment isolation valves.

The SA system has the following intended function for 10 CFR 54.4(a)(1).

- Support primary containment isolation.

The SA system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The SA system has no intended functions for 10 CFR 54.4(a)(3).

USAR References

Section X-12.0

Components Subject to Aging Management Review

Instrument air system components (accumulators and piping) that provide support for SRVs and primary containment isolation are reviewed with the nitrogen system (Section 2.3.3.13). Nonsafety-related components of the IA and SA systems whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining IA and SA system components (including primary containment isolation components in the SA system and a second containment penetration in the IA system) are reviewed as listed below.

Table 2.3.3-10 lists the component types that require aging management review.

Table 3.3.2-10 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2010-SH01
LRA-2010-SH02
LRA-2010-SH03
LRA-2019-SH01
LRA-2020
LRA-2022-SH01
LRA-2028
LRA-2038-SH01
LRA-13095.12-FSK-1-1

2.3.3.11 Reactor Equipment Cooling

System Description

The purpose of the reactor equipment cooling (REC) system is to provide cooling to safety-related and nonsafety-related plant equipment. Cooling water required for safety-related systems is supplied to the RHR pump seal water coolers and to room cooling for the ECCS areas: the equipment area cooling (EAC) system cooling coils in each of the reactor building corners and the EAC system cooling coil in the HPCI room. Cooling is provided to nonsafety-related equipment in the drywell, reactor building, control building, radwaste building, and augmented radwaste building during normal planned station operations.

The REC system consists of two subsystems, each with two centrifugal pumps discharging to one REC heat exchanger with associated valves and piping. Either of the two subsystems is capable of adequately delivering demineralized water to the required equipment during postulated transient or accident conditions with one REC pump operating. REC system heat exchangers are cooled by the service water system. Nonsafety-related equipment is provided with common supply and return headers, and motor-operated valves are provided to isolate these nonsafety-related cooling loads under accident conditions. Flexibility of system operation is provided with the interconnection of the two subsystems through crosstie lines equipped with normally open isolation valves. This assures the system will still function under a variety of degraded conditions.

A 550-gallon capacity surge tank, located at the highest point of the system, accommodates system volume changes, maintains static pressure in the REC subsystems, detects gross leaks in the REC system, and provides a means for adding makeup water. Makeup water to the REC system from the non-essential demineralized water storage tank is supplied by a connection from the demineralized water transfer pump to the surge tank.

The REC system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide cooling to the ECCS areas and the RHR pump seal water coolers.
- Support primary containment isolation.

The REC system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The REC system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

USAR References

Section X-6.0

Components Subject to Aging Management Review

Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining REC system components are reviewed as listed below.

Table 2.3.3-11 lists the component types that require aging management review.

Table 3.3.2-11 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2031-SH01
LRA-2031-SH02
LRA-2031-SH03
LRA-2036-SH01

2.3.3.12 Plant Drains

System Description

As described in USAR Chapter X, Section 14.0, the plant drains consist of equipment and floor drainage components that handle both normal and radioactive drainage. These components are in various plant systems: non-radioactive floor drains (FDN), radwaste (RW), air removal (AR), off-gas (OG), and the FPC system (described in Section 2.3.3.9). The grouping of components that perform a similar function from various plant systems into a consolidated review is appropriate as indicated in NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Section 2.1.3.1.

Plant drains components provide a path for flood water, maintain the integrity of secondary containment via loop seals, improve the control room pressurization boundary via loop seals, control leakage past the primary and secondary barriers in an event of flooding, and provide drainage support for safety-related systems.

Drainage is collected in seven equipment sumps, eighteen floor drain sumps (radioactive and non-radioactive), three electrical manhole sumps, and one chemical drain sump. The waste water collected in the sumps is then transferred to the river or to the radwaste building as required for filtration, demineralization, sampling, and analysis prior to either dilution and safe disposal into the discharge flume or re-use in the station.

The Z Sump, located beneath the elevated release point (ERP), receives drainage from the standby gas treatment system (SGT) and the OG system. The Z sump provides an active safety function of pumping out the collected water, which would otherwise eventually fill the sump and backup into the SGT exhaust line, impeding the flow of air. The Z sump pumps normally discharge to the waste collector tank. An alternate path, via a 3-way valve, is to the floor drain collector tank.

A differential pressure (Δp) can occur between the off-gas hold-up line and the Z sump. This operational condition can result in liquid being held up in the line. In order to mitigate this condition that would interfere with post-accident Z sump operation, the off-gas liquid drain line has a flow restrictor to ensure that the drain rate is less than the capacity of one Z sump pump. In addition, an off-gas Δp equalization line and Δp pressure monitoring equipment is installed to equalize the vacuum between the off-gas hold-up line and the Z sump.

The following systems contain components that are included in the review of plant drains.

Non-Radioactive Floor Drains System

The purpose of the FDN system is to collect and remove non-radioactive liquid from its point of origin to appropriate discharge to the river. The system includes floor drains, sumps, and sump pumps with associated piping and valves.

Two portable gasoline-powered pumps and 100-foot minimum (per pump) of two-and-a-half inch non-collapsible hose are available on site for use in flood protection.

The FDN system has no intended functions for 10 CFR 54.4(a)(1).

The FDN system has the following intended functions for 10 CFR 54.4(a)(2).

- Support control room envelope pressurization with loop seals.
- Maintain secondary containment integrity with loop seals in drains.
- Provide adequate drainage in locations where essential equipment is protected by floor drains and gasoline-powered pumps from an external flooding event.
- Provide adequate drainage in locations where essential equipment is protected by floor drains from flooding in the event of a pipe break.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The FDN system has no intended functions for 10 CFR 54.4(a)(3).

Radwaste System

The purpose of the RW system is to collect, process, store and dispose of radioactive liquid wastes and to collect, process, package, and provide temporary storage facilities for solid wastes prior to shipment for off-site processing and/or disposal.

The liquid radwaste portion of the RW system includes piping and equipment drains carrying potentially radioactive wastes; floor drain systems in areas which may contain potentially radioactive wastes; tanks, piping, pumps, process equipment, instrumentation and auxiliaries necessary to collect, process, store, and dispose of potentially radioactive wastes; and tanks and sumps used to collect potentially radioactive wastes.

Two RW system valves in the reactor vessel bottom drain line support the RCS (and RWCU) pressure boundary. The RW system contains components that support primary containment isolation. Several components in the RW system are associated with the Z sump and have the safety function of keeping the Z sump drained to assure SGT system function as well as maintaining a barrier to ground level release from the Z sump during accidents where the SGT system must operate.

The solid radwaste portion of the RW system reclaims the liquid phase of the wet solid wastes for reuse within the station and prepares the solid waste for off-site shipment with minimum exposure of the operators to radiation. Prior to off-site shipment to a licensed burial ground, solid wastes can be temporarily stored on site in shielded areas. Components associated with solid waste include tanks, pumps, and associated piping and valves.

The RW system has the following intended functions for 10 CFR 54.4(a)(1).

- Support Z sump function to assure SGT system operation.
- Provide a barrier to ground level release via the Z sump during accidents where the SGT system must operate.
- Support primary containment isolation.
- Maintain integrity of the reactor coolant pressure boundary.

The RW system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain secondary containment integrity with loop seals in drains.
- Provide adequate drainage in locations where essential equipment is protected by floor drains and gasoline-powered pumps from an external flooding event.
- Provide adequate drainage in locations where essential equipment is protected by floor drains from flooding in the event of a pipe break.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The RW system has the following intended function for 10 CFR 54.4(a)(3).

- Perform functions that demonstrate compliance with the Commission’s regulations for fire protection (10 CFR 50.48) (provide adequate drainage for the projected quantity of spray water and oil spills in the MG set areas; provide adequate drainage for the projected quantity of spray water in the SGT room).

Air Removal

The purpose of the AR system is to remove noncondensible gases from the condenser. The system includes two steam jet air ejector units complete with inter- and after-condensers to remove air and noncondensible gases from the main condenser. Mechanical vacuum pumps are provided for startup and shutdown.

Noncondensible gases and entrained vapor from the after-condenser are exhausted to the off-gas system. Air ejector exhaust is metered, sampled, and monitored prior to entering the off-gas holdup piping. Discharge from the mechanical vacuum pumps is routed to the off-gas system (the gland seal holdup subsystem), since average gaseous activity is low during startup and shutdown.

The AR system contains two safety-related valves which support the Z sump function. Components associated with the Z sump have the safety functions of keeping the Z sump drained to assure SGT system function and maintaining a barrier to ground level release via the Z sump during accidents where the SGT system must operate.

The AR system has the following intended functions for 10 CFR 54.4(a)(1).

- Support Z sump function to assure SGT system operation.
- Provide a barrier to ground level release via the Z sump during accidents where the SGT system must operate.

The AR system has no intended functions for 10 CFR 54.4(a)(2) or (a)(3).

Off-Gas System

The purpose of the OG system is to collect and process gaseous radioactive effluents to minimize their release to the atmosphere. The OG system receives gaseous radwaste from the main condenser steam jet air ejectors, the mechanical vacuum pumps, the gland steam condensers, and other minor sources. The OG system includes the air ejector off-gas subsystem and the gland seal off-gas subsystem.

The OG system includes components that support drainage of the Z sump and integrity of the Z sump system. These components are safety-related.

The OG system has the following intended functions for 10 CFR 54.4(a)(1).

- Support Z sump function to assure SGT system operation.
- Provide a barrier to ground level release via the Z sump during accidents where the SGT system must operate.

The OG system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The OG system has no intended functions for 10 CFR 54.4(a)(3).

Fuel Pool Cooling and Cleanup

The FPC system is described in Section 2.3.3.9.

USAR References

FDN: Sections X-14.0 (non-radioactive drains only), X-10.4.5.2 (loop seals for control room pressurization boundary), and V-3.3.4 (secondary containment loop seals).

RW: Sections IX-2.0, IX-3.0 and X-14.0

AR: Section XI-4.0 (main condenser gas removal)

OG: Section IX-4.3

Components Subject to Aging Management Review

RW system components in the reactor coolant pressure boundary are reviewed with the reactor coolant system pressure boundary (Section 2.3.1.3). RW system components that support primary containment isolation are reviewed with the primary containment system (Section 2.3.2.7). RW components associated with the instrument air system (drywell equipment and floor drain sump pump discharge isolation valves) are reviewed with the instrument air system (Section 2.3.3.10). Nonsafety-related components of the FDN, RW, and OG system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in scope for (a)(2) (Section 2.3.3.14). Remaining plant drains components (FDN system gasoline-powered pumps, loop seals, and drainage; RW system components associated with the Z sump and with providing drainage; and AR and OG systems components associated with the Z sump) are reviewed as listed below.

Table 2.3.3-12 lists the component types that require aging management review.

Table 3.3.2-12 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

LRA-2005-SH02
LRA-2009
LRA-2028
LRA-2030-SH01
LRA-2032-SH02
LRA-2033-SH02
LRA-2037
LRA-2038-SH01
LRA-2038-SH02
LRA-2077

Loop seals that are installed in the equipment and floor drains in the cable spreading room to improve the control room pressurization boundary are not shown on plant drawings. In lieu of LRA drawings, the loop seal locations are described in the following table.

Table 2.3.3.12-A
Loop Seal Locations

Loop Seal	Description
1	Loop seal #1 is installed in the 3” equipment drain line that starts in the 125/250V battery room 1A, and extends across the ceiling until it exits the room above the doors. The loop seal is located in the control building corridor (elevation 903’-6”) in the drain line between pipe supports FDN-H599 and FDN-S74.
2	Loop seal #2 is installed in the 3” west floor drain line, in the pipe directly under the drain located in the control room corridor. The loop seal is located south of pipe support FDN-H231.
3	Loop seal #3 is installed in the east floor drain line. This 3” drain pipe is located in the auxiliary relay room where it drops through the floor and into the control building basement. The loop seal is located between pipe supports FDN-H233 and FDN-S69 in the control building basement.

Floor drain flow paths from the floor drain to the sump tanks in the control building are shown only on plant layout and equipment drawings that are not suitable for LRA drawings. In lieu of LRA drawings, the floor drain routing is provided in the following table.

Table 2.3.3.12-B
Floor Drain Flow Paths

Route Number	Description
1	Drainage flows from control building drains located on EL 918'-0", to the control building floor drain sumps. These drains provide adequate drainage support in the event of internal flooding to support safety-related equipment in the cable spreading room.
2	Drainage flows from control building drains located inside the north entrance of the control building on EL 903'-6", to the control building floor drain sumps. These drains support leakage past primary and secondary barriers in the event of external flooding to support the operation of the dc switchgear and battery chargers.
3	Drainage flows from control building drains located on EL 882'-6", to the control building floor drain sumps. These drains provide adequate drainage support for the operation of the service water booster pumps and critical busses in the event of external or internal flooding.

2.3.3.13 Nitrogen

System Description

The purpose of the nitrogen (N_2) system is to provide combustible gas control of primary containment by maintaining an atmosphere of less than four percent oxygen. The system performs initial purging of the primary containment and provides an automatic supply of makeup nitrogen. The purging equipment converts liquid nitrogen into gaseous nitrogen which is then introduced into the suppression chamber or the drywell where it mixes with the air. Makeup nitrogen is supplied by a pressure control valve whenever drywell pressure falls below a selectable value, which maintains the drywell pressurized slightly above atmospheric pressure. The system is not required to operate following a design basis event.

When primary containment is inerted, the reliable instrument air header (see Section 2.3.3.10) is isolated from loads inside the primary containment to prevent air leakage into the drywell from the valve operators. Loads inside the primary containment are then supplied by the N_2 system. The reliable instrument air header is available as a backup. (The N_2 system has no containment isolation function because the containment isolation valves for the nitrogen supply to containment are components in either the PC system or the IA system.)

The N_2 system is available as a backup to instrument air system accumulators inside primary containment as needed to assure proper valve operation inside primary containment after a fire.

The N_2 system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The N_2 system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

USAR References

Section V-2.3.8.2, X-12.3.3.2

Components Subject to Aging Management Review

N_2 system components are reviewed as listed below.

Table 2.3.3-13 lists the component types that require aging management review.

Table 3.3.2-13 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawing.

LRA-2010-SH02

LRA-2022-SH01

LRA-2022-SH03

LRA-2084

2.3.3.14 Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

As discussed in Sections 2.1.1.2 and 2.1.2.1.2, systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) interact with safety-related systems in one of two ways: functional or physical. A functional failure is one where the failure of a nonsafety-related SSC to perform its function impacts a safety function. A physical failure is one where a safety function is impacted by the loss of structural or mechanical integrity of an SSC.

Functional Failure

Functional failures of nonsafety-related SSCs which could impact a safety function are identified with the individual system's evaluation and are not discussed in this section.

Physical Failure

This section summarizes the scoping and screening results for auxiliary systems based on 10 CFR 54.4(a)(2) because of the potential for physical interactions with safety-related equipment. Physical failures may be related to structural support or to spatial interaction.

Nonsafety-Related Systems or Components Directly Connected to Safety-Related Systems (Structural Support)

At CNS, certain components and piping outside the safety class pressure boundary must be structurally sound in order to maintain the pressure boundary integrity of safety class piping. Systems containing such nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems) are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2).

Nonsafety-Related Systems or Components with the Potential for Spatial Interaction with Safety-Related Systems or Components

The following modes of spatial interaction are described in Sections 2.1.1.2 and 2.1.2.1.2.

Physical Impact or Flooding

The evaluation of interactions due to physical impact or flooding resulted in the inclusion of structures and structural components. Structures and structural components are reviewed in Section 2.4.

Pipe Whip, Jet Impingement, or Harsh Environments

Systems containing nonsafety-related high energy lines that can affect safety-related equipment are included in this review. Where this criterion affected auxiliary systems, those systems are within the scope of license renewal per 10 CFR 54.4(a)(2).

Leakage or Spray

Nonsafety-related system components or nonsafety-related portions of safety-related systems containing oil, steam or liquid are considered within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) if such components are located in a space containing safety-related SSCs. Auxiliary systems meeting this criterion are within the scope of license renewal per 10 CFR 54.4(a)(2).

The following auxiliary systems, described in the referenced sections, are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) for physical interactions.

Table 2.3.3.14-A
Auxiliary Systems within the Scope of License Renewal Based on the Potential for Physical Interaction with Safety-Related Components (10 CFR 54.4(a)(2))

System Name	Section Describing System
Auxiliary Condensate Drains	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Auxiliary Steam	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Control Rod Drive	Section 2.3.3.2, Control Rod Drive
Demineralized Water	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Diesel Generator Fuel Oil	Section 2.3.3.5, Fuel Oil
Diesel Generator Jacket Water	Section 2.3.3.4, Diesel Generator
Diesel Generator Starting Air	Section 2.3.3.4, Diesel Generator
Fire Protection	Section 2.3.3.6, Fire Protection – Water Section 2.3.3.7, Halon and CO2
Nonradioactive Floor Drains	Section 2.3.3.12, Plant Drains
Fuel Pool Cooling and Cleanup	Section 2.3.3.9, Fuel Pool Cooling and Cleanup
Heating and Ventilation	Section 2.3.3.8, Heating, Ventilation and Air Conditioning
Instrument Air	Section 2.3.3.10, Instrument Air
Nuclear Boiler Instrumentation	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Off-Gas	Section 2.3.3.12, Plant Drains
Optimum Water Chemistry	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Post-Accident Sample	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)

Table 2.3.3.14-A (Continued)
Auxiliary Systems within the Scope of License Renewal
Based on the Potential for Physical Interaction
with Safety-Related Components (10 CFR 54.4(a)(2))

System Name	Section Describing System
Potable Water	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Radiation Monitoring—Process	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Radiation Monitoring—Vent	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Radwaste	Section 2.3.3.12, Plant Drains
Reactor Equipment Cooling	Section 2.3.3.11, Reactor Equipment Cooling
Reactor Recirculation	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Reactor Recirculation Lube Oil	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Reactor Water Cleanup	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Service Air	Section 2.3.3.10, Instrument Air
Service Water	Section 2.3.3.3, Service Water
Standby Liquid Control	Section 2.3.3.1, Standby Liquid Control
Standby Nitrogen Injection	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)
Turbine Equipment Cooling	Section 2.3.3-14, Auxiliary Systems in Scope for (a)(2)

System Description

The following systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) are not described elsewhere in the application. Each system has the following intended function.

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

This review includes components that support this intended function. For systems with intended functions that meet additional scoping criteria, the other intended functions are noted in the descriptions below with a reference to the section where the affected components are evaluated (e.g., Section 2.3.2.7, Primary Containment, for primary containment penetrations).

Auxiliary Condensate Drains

The purpose of the auxiliary condensate drains (ACD) system is to provide the capability to remove condensation from plant air conditioners and heating coils and from steam lines of the auxiliary steam boiler system.

Auxiliary Steam

The purpose of the auxiliary steam (AS) system is to transfer steam from the auxiliary steam boilers to various plant components. Steam is provided for such uses as heating buildings, space humidifiers, air conditioning system reheat coils, performance of minimum power tests on turbines for HPCI and RCIC pumps, and backup supply for the steam jet air ejectors and steam seals for the main turbine and reactor feedwater pump.

The AS system includes components in the MSIV leakage pathway.

The AS system has the following additional intended function for 10 CFR 54.4(a)(2).

- Direct post-accident MSIV leakage to the main condenser.

Components in the MSIV leakage pathway are reviewed in Section 2.3.4.1, MSIV Leakage Pathway.

Demineralized Water

The purpose of the demineralized water (DW) system is to store and supply demineralized water for systems containing reactor coolant and for other demineralized water requirements.

Two transfer pumps provide demineralized makeup water from the demineralized water storage tank to various systems in the plant, including the heating boiler, DG jacket water system, CRD system, and the drywell. This makeup function is not a safety function as it is not required to be performed post-accident. The DW system includes two valves required for primary containment isolation.

The DW system contains components that provide loop seals for the standby gas treatment system.

The DW system has the following intended function for 10 CFR 54.4(a)(1).

- Support primary containment isolation.

The DW system has the following additional intended function for 10 CFR 54.4(a)(2).

- Maintain loops seals in support of SGT system function.

Containment isolation components are reviewed in Section 2.3.2.7, Primary Containment. Components that maintain loop seals in the SGT system are reviewed with that system (Section 2.3.2.6).

Nuclear Boiler Instrumentation

The purpose of the nuclear boiler instrumentation (NBI) system is to monitor and transmit information concerning key reactor vessel operating parameters during normal operations and abnormal and accident conditions to ensure that sufficient indication of these parameters is possible. NBI system components maintain the integrity of the reactor coolant pressure boundary.

The parameters monitored during plant operation are reactor core flow rate, reactor vessel water level, reactor vessel pressure, and reactor vessel top head flange leakage. Vessel temperature is also monitored.

The NBI system consists of instrumentation tubing, valves, pressure reducers, transmitters, condensing chambers, and various other support equipment. The NBI system contains numerous manual valves that function as instrument shutoff, vent drain, calibration and equalization valves and as rack shutoff valves. NBI system valves also function as primary containment isolation valves.

The NBI system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide reactor vessel operating parameter information as required.
- Support primary containment.
- Maintain integrity of reactor coolant pressure boundary.

The NBI system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).
- Perform a function that demonstrates compliance with the Commission’s regulations for station blackout (10 CFR 50.63).

Components in the reactor coolant pressure boundary are reviewed with the reactor coolant system pressure boundary (Section 2.3.1). Two components that maintain the core spray system pressure boundary are reviewed with the core spray system (Section 2.3.2.2).

Optimum Water Chemistry

The purpose of the optimum water chemistry (OWC) system is to prevent and reduce the growth rates of inter-granular stress corrosion cracking (IGSCC) in recirculation piping and wetted reactor vessel internals. Zinc (Zn) is injected into feedwater to maintain reactor coolant zinc concentration. Hydrogen is injected into the condensate system to reduce the electrochemical potential in the RCS. The original design included oxygen generation; however, the oxygen generation portion of the system is abandoned in place.

Post-Accident Sample

The purpose of the post-accident sample (PAS) system is to provide a means to obtain process samples under post-accident conditions. Samples are obtained from outside primary containment (e.g., reactor coolant from the reactor recirculation loop). The PAS system has no containment isolation function because the containment atmosphere sample isolation valves are in the primary containment system (Section 2.3.2.7).

Potable Water

The purpose of the potable water (PW) system is to provide the potable (drinking) water supplies and sanitation water necessary for normal station operations. Water for drinking and sanitary use is supplied from wells on site. Shower and lavatory waste water that does not contain radioactive material is directed to a sewage treatment system.

Radiation Monitoring—Process

The purpose of the radiation monitoring—process (RMP) system is to monitor radiation levels in various process streams, including the following:

- air ejector off-gas,
- process liquid, and
- elevated release point.

Radiation monitoring for ventilation systems is performed by the radiation monitoring—vent system.

The safety-related monitoring functions performed by the RMP system are performed by EIC components; there are no safety-related mechanical components in the RMP system.

Radiation Monitoring—Vent

The purpose of the radiation monitoring—vent (RMV) system is to monitor radiation levels in various ventilation streams, including the following:

- reactor building isolation ventilation,
- radwaste/augmented radwaste building ventilation,
- multi-purpose facility ventilation,
- turbine building ventilation, and
- reactor building ventilation.

The RMV system includes containment isolation valves for the atmospheric radiation monitor.

The RMV system has the following intended functions for 10 CFR 54.4(a)(1).

- Support primary containment isolation.

Containment isolation components are reviewed in Section 2.3.2.7, Primary Containment.

Reactor Recirculation

The purpose of the reactor recirculation (RR) system is to provide a variable forced coolant flow through the core to remove heat from the fuel. The forced coolant flow removes more heat from the fuel than would be possible with just natural circulation. The recirculation system also controls reactivity over a wide span of reactor power by varying the recirculation flow rate to control the void content of the moderator.

The RR 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 variable speed motor driven recirculation pump driven by a motor generator (MG) set to control pump speed, and associated piping and valves. The jet pumps are components in the nuclear boiler system (Section 2.3.1.3). The recirculation loops are part of the reactor coolant pressure boundary and are located inside the drywell structure. The RHR system uses RR system piping in the reactor coolant pressure boundary as an injection path for LPCI and for shutdown cooling.

The RR system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide a flow path for LPCI injection into the vessel and for shutdown cooling.
- Maintain integrity of reactor coolant pressure boundary.

The RR system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR50.48) (provide a flow path for RHR system into the vessel for shutdown cooling).

Components associated with the reactor coolant pressure boundary are reviewed with the reactor coolant system pressure boundary (Section 2.3.1.3).

Reactor Recirculation Lube Oil

The purpose of the reactor recirculation—lube oil (RRLO) system is to provide clean, pressurized lubricating oil to the RR system MG sets. The system has no safety function.

Reactor Water Cleanup

The purpose of the reactor water cleanup (RWCU) system is to maintain high reactor water purity to limit chemical and corrosive action, and to limit the reactor water impurities available for neutron flux activation by removing corrosion products. The RWCU system also provides a method for decreasing reactor water inventory during heatup.

The RWCU system removes impurities from the reactor coolant water by continuously removing a portion of the reactor coolant from the bottom head drain and the suction side of a reactor recirculation pump, sending the removed flow through filter-demineralizer units to undergo mechanical filtration and ion exchange processes, and returning the processed fluid back to the reactor via the reactor feedwater line.

The RWCU system consists of two recirculation pumps, regenerative and nonregenerative heat exchangers, and two filter-demineralizer units, with associated piping and valves.

The RWCU system has the following intended functions for 10 CFR 54.4(a)(1).

- Support primary containment isolation.
- Maintain integrity of reactor coolant pressure boundary.

The RWCU system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (isolation).

Components associated with the reactor coolant pressure boundary are reviewed in Section 2.3.1.3. The primary containment isolation valves are in the reactor coolant pressure boundary.

Standby Nitrogen Injection

The purpose of the standby nitrogen injection (SBNI) system is to provide a source of nitrogen for containment inerting following a primary pressure boundary LOCA in conjunction with failure or degradation of ECCS. This function is beyond the design basis of the plant and is therefore not a safety function.

Containment isolation valves associated with the SBNI system are components in the PC system. One SBNI valve supports the nitrogen system pressure boundary and is reviewed in Section 2.3.3.13.

Turbine Equipment Cooling

The purpose of the turbine equipment cooling (TEC) system is to provide cooling to equipment located in the turbine building, to the station air conditioning systems, and to certain equipment in the control building, radwaste building, heating boiler room, and intake structure. The TEC system does not provide cooling to safety-related equipment. Cooling provided to the main control room air conditioning system can be manually transferred from the TEC system to the service water system if required; however, this cooling function is not a safety function.

The TEC system consists of a single closed loop with three half-sized pumps, two heat exchangers, a surge tank, a filter-demineralizer, and associated piping and valves.

USAR References

The following table lists the USAR references for systems described in this section.

System	USAR Section
Auxiliary Condensate Drains	Section X-10.1.1
Auxiliary Steam	Section X-10.1.1
Demineralized Water	Section X-11.0
Nuclear Boiler Instrumentation	Section VII-8.0
Optimum Water Chemistry	Section X-19.0
Post-Accident Sample	Section X-15.0

System	USAR Section
Potable Water	Section X-13.0
Radiation Monitoring—Process	Section VII-12.0
Radiation Monitoring—Vent	Section VII-12.0
Reactor Recirculation	Section IV-3.0, Sections IV-8.5.2 and 8.5.4 (interface with RHR/LPCI)
Reactor Recirculation Lube Oil	None
Reactor Water Cleanup	Section IV-9.0
Standby Nitrogen Injection	Section V-2.3.8.3
Turbine Equipment Cooling	Section X-7.0

Components Subject to Aging Management Review

For structural support, components subject to aging management review are those nonsafety-related components connected to safety-related components up to the first seismic anchor or base-mounted component. Scope was typically determined by the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a base-mounted component, flexible connection, or the end of a piping run (such as a vent or drain line).

For spatial interaction, auxiliary system components containing oil, steam, or liquid and located in spaces containing safety-related equipment are subject to aging management review if not already included in another system review. Components are excluded from review if their location is such that no safety function can be impacted by component failure. If a HELB analysis assumes that nonsafety-related piping in an auxiliary system does not fail or assumes failure only at specific locations, then that piping is within the scope of license renewal per 10 CFR 54.4(a)(2). Appropriate components are subject to aging management review in order to provide reasonable assurance that those analysis assumptions remain valid through the period of extended operation.

Series 2.3.3-14-xx tables list the component types for auxiliary systems that require aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Series 3.3.2-14-xx tables provide the results of the aging management review for auxiliary systems for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Table 2.3.3.14-B
Auxiliary Systems 10 CFR 54.4(a)(2) Aging Management Review Tables

System Name	Series 2.3.3-14-xx Table	Series 3.3.2-14-xx Table
Auxiliary Condensate Drains	Table 2.3.3-14-1	Table 3.3.2-14-1
Auxiliary Steam	Table 2.3.3-14-2	Table 3.3.2-14-2
Control Rod Drive	Table 2.3.3-14-3	Table 3.3.2-14-3
Demineralized Water	Table 2.3.3-14-4	Table 3.3.2-14-4
Diesel Generator Fuel Oil	Table 2.3.3-14-5	Table 3.3.2-14-5
Diesel Generator Jacket Water	Table 2.3.3-14-6	Table 3.3.2-14-6
Diesel Generator Starting Air	Table 2.3.3-14-7	Table 3.3.2-14-7
Fire Protection	Table 2.3.3-14-8	Table 3.3.2-14-8
Floor Drains, Nonradioactive	Table 2.3.3-14-9	Table 3.3.2-14-9
Fuel Pool Cooling and Cleanup	Table 2.3.3-14-10	Table 3.3.2-14-10
Heating and Ventilation	Table 2.3.3-14-11	Table 3.3.2-14-11
Instrument Air	Table 2.3.3-14-12	Table 3.3.2-14-12
Nuclear Boiler Instrumentation	Table 2.3.3-14-13	Table 3.3.2-14-13
Off-Gas	Table 2.3.3-14-14	Table 3.3.2-14-14
Optimum Water Chemistry	Table 2.3.3-14-15	Table 3.3.2-14-15
Post-Accident Sample	Table 2.3.3-14-16	Table 3.3.2-14-16
Potable Water	Table 2.3.3-14-17	Table 3.3.2-14-17
Reactor Equipment Cooling	Table 2.3.3-14-18	Table 3.3.2-14-18
Radiation Monitoring—Process	Table 2.3.3-14-19	Table 3.3.2-14-19
Radiation Monitoring—Vent	Table 2.3.3-14-20	Table 3.3.2-14-20
Reactor Recirculation	Table 2.3.3-14-21	Table 3.3.2-14-21
Reactor Recirculation Lube Oil	Table 2.3.3-14-22	Table 3.3.2-14-22
Radwaste	Table 2.3.3-14-23	Table 3.3.2-14-23
Reactor Water Cleanup	Table 2.3.3-14-24	Table 3.3.2-14-24
Service Air	Table 2.3.3-14-25	Table 3.3.2-14-25

Table 2.3.3.14-B (Continued)
Auxiliary Systems 10 CFR 54.4(a)(2) Aging Management Review Tables

System Name	Series 2.3.3-14-xx Table	Series 3.3.2-14-xx Table
Service Water	Table 2.3.3-14-26	Table 3.3.2-14-26
Standby Liquid Control	Table 2.3.3-14-27	Table 3.3.2-14-27
Standby Nitrogen Injection	Table 2.3.3-14-28	Table 3.3.2-14-28
Turbine Equipment Cooling	Table 2.3.3-14-29	Table 3.3.2-14-29

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

Table 2.3.3.14-C
LRA Drawings for Auxiliary Systems in Scope
for 10 CFR 54.4(a)(2) for Physical Interactions

System	Drawing Numbers	
Auxiliary Condensate Drains	LRA-2012-SH01 LRA-2012-SH02 LRA-2012-SH04	LRA-2012-SH05 LRA-2018 LRA-2041
Auxiliary Steam	LRA-2002-SH02 LRA-2002-SH03 LRA-2012-SH01 LRA-2012-SH02	LRA-2012-SH04 LRA-2012-SH05 LRA-2018
Control Rod Drive	LRA-2026-SH01 LRA-2039 LRA-2042-SH01	
Demineralized Water	LRA-2004-SH01 LRA-2005-SH01 LRA-2005-SH02 LRA-2006-SH03 LRA-2007	LRA-2009 LRA-2013 LRA-2018 LRA-2029 LRA-2031-SH02
Diesel Generator Fuel Oil	LRA-2077	

Table 2.3.3.14-C (Continued)
LRA Drawings for Auxiliary Systems in Scope
for 10 CFR 54.4(a)(2) for Physical Interactions

System	Drawing Numbers	
Diesel Generator Jacket Water	LRA-DG-JW	
Diesel Generator Starting Air	LRA-2077	
Fire Protection	LRA-2016-SH01A	
Floor Drains, Nonradioactive	LRA-2005-SH01 LRA-2005-SH02 LRA-2016-SH01C	LRA-2038-SH01 LRA-2077
Fuel Pool Cooling and Cleanup	LRA-2005-SH01 LRA-2030-SH01	
Heating and Ventilation	LRA-2012-SH04 LRA-2018 LRA-2019-SH01	LRA-2019-SH02 LRA-2020 LRA-2024-SH02
Instrument Air	LRA-2010-SH01 LRA-2010-SH01A LRA-2010-SH02	LRA-2028 LRA-1309512-FSK-1-1
Nuclear Boiler Instrumentation	LRA-2026-SH01 LRA-2028	
Off-Gas	LRA-2005-SH01 LRA-2005-SH02 LRA-2009	
Optimum Water Chemistry	LRA-2004-SH03 LRA-2042-SH05	
Post-Accident Sample	LRA-2022-SH01 LRA-2027-SH01 LRA-2031-SH03 LRA-1309512-FSK-1-1	
Potable Water	LRA-2014-SH01	
Reactor Equipment Cooling	LRA-2031-SH01 LRA-2031-SH02 LRA-2031-SH03	LRA-2031-SH04 LRA-CNS-REC-54

Table 2.3.3.14-C (Continued)
LRA Drawings for Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) for Physical Interactions

System	Drawing Numbers	
Radiation Monitoring—Process	LRA-2031-SH03	
Radiation Monitoring—Vent	LRA-2020 LRA-2022-SH01 LRA-2022-SH02	
Reactor Recirculation	LRA-2027-SH01 LRA-2027-SH02	
Reactor Recirculation Lube Oil	LRA-2011-SH02	
Radwaste	LRA-2005-SH02 LRA-2028 LRA-2038-SH01	LRA-2038-SH02 LRA-2042-SH02
Reactor Water Cleanup	LRA-2027-SH01 LRA-2042-SH01 LRA-2042-SH02	LRA-2042-SH03 LRA-2042-SH04
Service Air	LRA-2010-SH03	
Service Water	LRA-2006-SH01 LRA-2006-SH03 LRA-2006-SH04 LRA-2006-SH05	LRA-2007 LRA-2036-SH01 LRA-2077
Standby Liquid Control	LRA-2045-SH02	
Standby Nitrogen Injection	LRA-2084	
Turbine Equipment Cooling	LRA-2007	

Table 2.3.3-1
Standby Liquid Control System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Accumulator	Pressure boundary
Bolting	Pressure boundary
Heater housing	Pressure boundary
Instrument snubber	Pressure boundary
Level gauge	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

**Table 2.3.3-2
Control Rod Drive System
Components Subject to Aging Management Review**

Component Type	Intended Function(s)
Accumulator	Pressure boundary
Bolting	Pressure boundary
Filter	Filtration
Filter housing	Pressure boundary
Piping	Pressure boundary
Rupture disk	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-3
Service Water System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Blank flange	Pressure boundary
Bolting	Pressure boundary
Flow element	Pressure boundary
Flow glass	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Strainer	Filtration
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-4
Diesel Generator System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Accumulator	Pressure boundary
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (housing)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Moisture separator housing	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Receiver	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Sight glass	Pressure boundary
Silencer	Pressure boundary
Standpipe	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary

Table 2.3.3-4 (Continued)
Diesel Generator System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Turbocharger	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-5
Fuel Oil System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flame arrestor	Flow control
Flexible connection	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-6
Fire Protection—Water System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Duct	Pressure boundary
Expansion joint	Pressure boundary
Flow element	Pressure boundary
Heater housing	Pressure boundary
Instrument snubber	Pressure boundary
Muffler	Pressure boundary
Nozzle	Pressure boundary Flow control
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Retarding chamber	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary
Vortex breaker	Flow control

Table 2.3.3-7
Halon and CO_2 System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Accumulator	Pressure boundary
Bolting	Pressure boundary
Coil—heating or cooling	Pressure boundary
Flex hose	Pressure boundary
Level gauge	Pressure boundary
Nozzle	Pressure boundary Flow control
Piping	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-8
Heating, Ventilation and Air Conditioning System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Duct flexible connection	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (drain pan)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (housing)	Pressure boundary
Heat exchanger (pipe component)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Louver housing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-9
Fuel Pool Cooling and Cleanup System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Panel	Neutron absorption

Table 2.3.3-10
Instrument Air System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Accumulator	Pressure boundary
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flexible connection	Pressure boundary
Lubricator	Pressure boundary
Piping	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-11
Reactor Equipment Cooling System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Flex hose	Pressure boundary
Flow element	Pressure boundary
Flow glass housing	Pressure boundary
Flow indicator	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Pressure boundary Heat transfer
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-12
Plant Drains
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Hose	Pressure boundary
Piping	Pressure boundary Flow control
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary Flow control
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-13
Nitrogen System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Accumulator	Pressure boundary
Bolting	Pressure boundary
Coil	Pressure boundary
Coil—heating or cooling	Pressure boundary
Filter housing	Pressure boundary
Flex hose	Pressure boundary
Piping	Pressure boundary
Rupture disc	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-14-1
Auxiliary Condensate Drains System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-2
Auxiliary Steam System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Strainer housing	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

**Table 2.3.3-14-3
Control Rod Drive System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function[1]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flow element	Pressure boundary
Flow indicator	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Instrument snubber	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Strainer housing	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-4
Demineralized Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flow indicator	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-5
Diesel Generator Fuel Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-6
Diesel Generator Jacket Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-7
Diesel Generator Starting Air System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-8
Fire Protection System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Accumulator	Pressure boundary
Bolting	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-9
Floor Drains, Nonradioactive System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-10
Fuel Pool Cooling and Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Flow indicator	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-11
Heating and Ventilation System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Coil	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Flow element	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-12
Instrument Air System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Accumulator	Pressure boundary
Bolting	Pressure boundary
Filter housing	Pressure boundary
Piping	Pressure boundary
Restriction orifice	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-13
Nuclear Boiler Instrumentation System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flow element	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-14
Off-Gas System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Sight glass	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-15
Optimum Water Chemistry System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Flow element	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-16
Post-Accident Sample System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-17
Potable Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-18
Reactor Equipment Cooling System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Deaerator	Pressure boundary
Demineralizer	Pressure boundary
Filter housing	Pressure boundary
Flow element	Pressure boundary
Flow indicator	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Separator	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-19
Radiation Monitoring—Process System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Flow indicator	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tubing	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-20
Radiation Monitoring—Vent System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-21
Reactor Recirculation System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-22
Reactor Recirculation Lube Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-23
Radwaste System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Eductor	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Strainer housing	Pressure boundary
Separator	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-24
Reactor Water Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Demineralizer	Pressure boundary
Eductor	Pressure boundary
Filter housing	Pressure boundary
Flow element	Pressure boundary
Flow indicator	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Instrument snubber	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-25
Service Air System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-26
Service Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.3-14-27
Standby Liquid Control System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[1]
Bolting	Pressure boundary
Flow indicator	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

**Table 2.3.3-14-28
Standby Nitrogen Injection System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function[1]
Bolting	Pressure boundary
Flow indicator	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

**Table 2.3.3-14-29
Turbine Equipment Cooling System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function[1]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flexible connection	Pressure boundary
Flow indicator	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

2.3.4 Steam and Power Conversion Systems

The following systems are included in this section.

- Section 2.3.4.1, MSIV Leakage Pathway
- Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

2.3.4.1 MSIV Leakage Pathway

System Description

As described in USAR Section IV-11, the MSIV leakage pathway has the safety objective of directing post-accident MSIV leakage to the main condenser. The seismic Class IIS main steam piping that is not part of the reactor coolant pressure boundary (RCPB) is credited with directing MSIV leakage from the MSIVs to the main turbine condenser during a loss of coolant accident (LOCA) and a control rod drop accident. For the LOCA, this alternate leakage treatment (ALT) pathway allows crediting the dose consequence mitigation assumptions related to leakage holdup and the resulting iodine plateout within the condenser.

The MSIV leakage pathway is composed of components in the auxiliary steam (AS), main condensate (MC) and main steam (MS) systems. As described in USAR Section XI-3, the main condenser has the safety design basis of providing MSIV leakage holdup and the resulting iodine partitioning and plateout within the condenser so that offsite doses do not exceed the allowable limits and control room occupant doses will not exceed GDC 19 limits.

The components in the MSIV pathway are normally operating and support the normal power operation objectives of providing the flow path for the steam to the main turbine and other secondary plant components. The main condenser has the power operation objective of providing a heat sink for the exhaust from the main turbine, turbine bypass steam and other flows.

The MSIV leakage pathway starts at the MSIVs as shown on drawing LRA-2041. The pathway includes the main steam lines up to the main turbine stop valves and other branch and drain piping such as the turbine bypass valves and piping as shown on LRA-2002 sheets 1, 2 and 3 and LRA-2005 sheet 1. These lines drain into the main condenser. The main condenser acts as the holdup volume to collect the MSIV leakage and allow plateout of the radioactive iodine.

Auxiliary Steam

The purpose of the AS system is to transfer steam from the auxiliary steam boilers to various plant components. The AS system is described in Section 2.3.3.14, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2), under Auxiliary Steam.

Main Condensate

The purpose of the main condensate (MC) system is, together with the reactor feedwater system, to provide a dependable, high-quality supply of makeup water to the reactor. The MC system provides a means of preheating the reactor feedwater.

Three one-third capacity motor-driven condensate pumps take the condensate from the condenser hotwells and pump it through the air ejector condensers (air removal system), gland seal condenser (condensate drains system), and condensate demineralizers (condensate filter demineralizer system) to the suction of three one-third capacity condensate booster pumps. The booster pumps supply two parallel streams, each with five stages of feedwater heaters, which supply the reactor feedwater pumps (reactor feedwater system).

The two main condensers provide the normal heat sink for the steam exhausted from the main turbine and the reactor feed pump turbines as well as steam passing through the turbine bypass valves. The main condensers provide holdup volume for post-LOCA MSIV leakage and allow for plateout of radioactive iodine.

The MC system has no intended functions for 10 CFR 54.4(a)(1).

The MC system has the following intended functions for 10 CFR 54.4(a)(2).

- Provide holdup and plateout of fission products in MSIV leakage.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The MC system has no intended functions for 10 CFR 54.4(a)(3).

Main Steam

The purpose of the main steam (MS) system is to conduct steam from the reactor vessel through the primary containment to the main turbine and other components that use reactor steam. Four steam lines conduct steam from the reactor through a shielded pipe tunnel to a pressure equalizing header. Two main branches from the header go to the main turbine and one branch to the main turbine bypass valve manifold, which discharges to the condenser. Reactor steam is also supplied to the HPCI and RCIC turbines, reactor feed pump turbines, the steam jet air ejectors, main turbine and reactor feed pump turbine gland seals, and the augmented off-gas system (for hydrogen dilution). Drain lines are connected to the low points of each main steam line both inside and outside the drywell.

The MS system includes the nuclear boiler system pressure relief system, consisting of three safety valves and eight safety/relief valves (SRVs) located on the main steam lines inside the drywell, before the first main steam isolation valve (MSIV). The safety valves and SRVs prevent overpressurization of the RCPB. The spring-loaded safety valves discharge directly to the drywell. The pilot-operated SRVs discharge to the suppression pool. SRV discharge is piped through individual discharge lines to T-quenchers located below the minimum water level in the suppression pool. Two 10-inch vacuum relief valves are provided on each SRV discharge line in the drywell to prevent drawing water up into the line due to steam condensation following termination of relief valve operation.

The automatic depressurization system (ADS), consisting of six of the SRVs, serves to back up the HPCI system under LOCA conditions. If the HPCI system does not operate, or during a small break LOCA in which HPCI is unable to maintain reactor water level, the reactor coolant system is depressurized sufficiently to permit the LPCI and core spray systems to operate to protect the fuel barrier. Depressurization occurs when some of the SRVs are opened automatically or manually to vent steam to the suppression pool. Motive force for SRV operation is normally provided by nitrogen. Backup air from the instrument air system can be supplied. The valves also have accumulators that will provide for the necessary valve actuations.

Main steam line flow restrictors are provided for each steam line downstream of the safety valves and SRVs 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 restrictor assembly consists of a venturi type nozzle insert welded into a carbon steel pipe.

Two MSIVs are provided in each steam line, one inside primary containment and one outside, to close automatically (1) to prevent damage to the fuel barrier by limiting the loss of reactor coolant in case of a major leak from the steam piping outside primary containment, and (2) to limit release of radioactive materials by closing the primary containment barrier in case of a major leak from the reactor coolant system inside primary containment. Each valve employs a pneumatic cylinder operator and closing springs as separate locally stored energy sources for rapid closure. The pneumatic cylinder uses air or nitrogen to operate the MSIV. An accumulator is provided as a backup to the air or nitrogen supply.

Main steam piping up to the second MSIV is part of the RCPB. Main steam piping from the MSIV to the condenser provides an MSIV leakage pathway to the condenser to direct radioactive nuclides contained in MSIV leakage following a postulated LOCA to the condenser. This alternate leakage pathway allows crediting the dose consequence mitigation assumptions related to leakage holdup and the resulting iodine plateout within the condenser.

The MS system provided steam to the RHR heat exchangers for the steam condensing mode of RHR system operation. This mode has been operationally abandoned and the steam supply isolated; however, valves in the MS system still support the RHR system pressure boundary.

The MS system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide relief for overpressurization of the RCS (safety valves and SRVs).
- Provide RCS depressurization as a backup to HPCI to allow flow from LPCI and core spray to enter the reactor vessel (ADS function).

- Limit loss of water from the reactor vessel before MSIV closure in the event of a main steam line rupture outside the primary containment.
- Limit release of radioactive materials by closing the primary containment barrier in case of a major leak from the reactor coolant system inside primary containment.
- Provide steam to the HPCI and RCIC turbines.
- Maintain integrity of reactor coolant pressure boundary (includes ADS components).

The MS system has the following intended functions for 10 CFR 54.4(a)(2).

- Direct post-accident MSIV leakage to the main condenser.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The MS system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (includes ADS function).
- Perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63) (provide steam to the HPCI and RCIC turbines, control RCS pressure using SRVs).

USAR References

AS: Section X-10.1.1

MC: Section XI-8.0, -3.0

MS: Sections IV-4.0, 5.0, 6.0, and 11.0, Section VI-4.2 (ADS), Section XI-5.0 (turbine bypass)

Components Subject to Aging Management Review

MS system components associated with the reactor coolant pressure boundary (ASME Class 1) are reviewed with the reactor coolant system pressure boundary (Section 2.3.1.3). MS system components that support the RHR system pressure boundary are reviewed with the residual heat removal system (Section 2.3.2.1). The non-Class 1 portion of the HPCI steam supply is reviewed with the high pressure coolant injection system (Section 2.3.2.4). (The non-Class 1 portion of the RCIC steam supply consists of RCIC system components, not MS system components.) The relief valve discharge piping in the MS system is reviewed with the automatic depressurization system (Section 2.3.2.3).

Nonsafety-related components of the MC and MS system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with steam and power conversion systems in scope for (a)(2) (Section 2.3.4.2). Components in the AS, MC, and MS systems in the MSIV leakage pathway are reviewed as listed below.

Table 2.3.4-1 lists the component types that require aging management review.

Table 3.4.2-1 provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

- LRA-2002-SH01
- LRA-2002-SH02
- LRA-2002-SH03
- LRA-2005-SH01
- LRA-2041

2.3.4.2 Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

As discussed in Sections 2.1.1.2 and 2.1.2.1.2, systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) interact with safety-related systems in one of two ways: functional or physical. A functional failure is one where the failure of a nonsafety-related SSC to perform its function impacts a safety function. A physical failure is one where a safety function is impacted by the loss of structural or mechanical integrity of an SSC.

Functional Failure

Functional failures of nonsafety-related SSCs which could impact a safety function are identified with the individual system's evaluation and are not discussed in this section.

Physical Failure

This section summarizes the scoping and screening results for steam and power conversion (S&PC) systems based on 10 CFR 54.4(a)(2) because of the potential for physical interactions with safety-related equipment. Physical failures may be related to structural support or to spatial interaction.

Nonsafety-Related Systems or Components Directly Connected to Safety-Related Systems (Structural Support)

At CNS, certain components and piping outside the safety class pressure boundary must be structurally sound in order to maintain the pressure boundary integrity of safety class piping. Systems containing such nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems) are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2).

Nonsafety-Related Systems or Components with the Potential for Spatial Interaction with Safety-Related Systems or Components

The following modes of spatial interaction are described in Sections 2.1.1.2 and 2.1.2.1.2.

> *Physical Impact or Flooding*
>
> The evaluation of interactions due to physical impact or flooding resulted in the inclusion of structures and structural components. Structures and structural components are reviewed in Section 2.4.

Pipe Whip, Jet Impingement, or Harsh Environments

Systems containing nonsafety-related high energy lines that can affect safety-related equipment are included in this review. Where this criterion affected S&PC systems, those systems are within the scope of license renewal per 10 CFR 54.4(a)(2).

Leakage or Spray

Nonsafety-related system components or nonsafety-related portions of safety-related systems containing oil, steam or liquid are considered within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) if such components are located in a space containing safety-related SSCs. S&PC systems meeting this criterion are within the scope of license renewal per 10 CFR 54.4(a)(2).

The following S&PC systems, described in the referenced sections, are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) for physical interactions.

Table 2.3.4.2-A
S&PC Systems within the Scope of License Renewal based on the Potential for Physical Interaction with Safety-Related Components (10 CFR 54.4(a)(2))

System Name	Section Describing System
Circulating Water	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Condensate Drains	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Condensate Filter Demineralizer	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Condensate Makeup	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Extraction Steam	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Main Condensate	Section 2.3.4.1, MSIV Leakage Pathway
Main Steam	Section 2.3.4.1, MSIV Leakage Pathway
Reactor Feedwater	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Reactor Feedwater Pump and Turbine Lube Oil	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Turbine Generator	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Turbine Generator EH Fluid	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Turbine Generator Lube Oil	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)
Turbine Lube Oil – Instruments	Section 2.3.4-2, S&PC Systems in Scope for (a)(2)

System Description

The following systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) are not described elsewhere in the application. Each system has the following intended function.

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

This review includes components that support this intended function. For systems with intended functions that meet additional scoping criteria, the other intended functions are noted in the descriptions below with a reference to the section where the affected components are evaluated (e.g., Section 2.3.2.7, Primary Containment, for primary containment penetrations).

Circulating Water

The purpose of the circulating water (CW) system is to provide the main condenser with a continuous supply of cooling water for removing the heat rejected by the turbine exhaust and turbine bypass steam as well as from other incidentals over the full range of operating loads.

The CW system uses water taken from the Missouri River through trash racks and then through traveling screens. The discharge from the condenser is returned via the discharge channel to the river.

The CW system includes four circulating water pumps and four screen wash pumps. The system has four sets of two each traveling water screens in parallel, each set to remove debris for each circulating water pump plus one screen serving the service water bay. Debris is removed from the screens by the spray wash assembly. The intake structure is divided into five bays, one for each of the circulating water pumps and one for the four service water pumps. Water can also be fed to the service water bay from the adjacent circulating water pump bay. A water jet sparger system is provided in the circulating water pump bays to clear light particles and keep smaller particles in suspension.

Seismic Class IIS Riverwell pumps in the CW system provide gland water to the RHRSW booster pumps. If the Riverwell supply is unavailable, gland water is aligned to the essential supply, which is the discharge of the booster pumps.

Condensate Drains

The purpose of the condensate drain (CD) system is to increase steam plant efficiency by preheating the incoming feedwater and thereby reducing the reactor plant heat load. The CD system includes drains from the feedwater heaters and other components that are directed to the condenser hotwell. The system includes the gland seal condenser.

Condensate Filter Demineralizer

The purpose of the condensate filter demineralizer (CF) system is to maintain the required purity of feedwater to the reactor. The system includes seven demineralizer units; five are required to provide full flow. The demineralizers remove contaminants from the feedwater by mechanical filtration and ion exchange.

Condensate Makeup

The purpose of the condensate makeup (CM) system is to provide condensate for system makeup needs, accept system reject surges, and provide condensate for continuous service needs and intermittent batch type services. The CM system includes the emergency condensate storage tanks (ECSTs), which provide water for ECCS systems; the main condensate storage tanks; and a CST recirculation pump, reactor building auxiliary condensate pump, and radwaste building auxiliary condensate booster pump, with associated system piping and valves.

The 450,000-gallon and 700,000-gallon main condensate storage tanks supply the various station requirements. The two tanks can receive demineralized makeup water from the water treatment plant or reprocessed water from the radwaste system with the smaller tank providing water to the larger tank. The tanks are constructed of coated carbon steel with electric heaters for anti-freeze protection. The 700,000-gallon tank has a steel retaining wall to prevent spillage from a tank rupture or overflow of radioactive water.

Two 50,000-gallon ECSTs, located in the basement of the control building, provide water for the HPCI system and the RCIC system. These tanks are supplied by the main condensate storage tanks. The ECSTs have adequate inventory for reactor coolant makeup via the HPCI and RCIC systems during the four-hour station blackout coping duration. The HPCI and RCIC systems, supplied from the ECSTs, are credited to achieve post-fire safe shutdown.

The CM system provides water for the standby gas treatment system moisture separator drain loop seals. The CM system provides water for spent fuel pool normal makeup.

The CM system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide water to the ECCS systems.

The CM system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

- Perform a function that demonstrates compliance with the Commission’s regulations for station blackout (10 CFR 50.63).

The ECSTs and CM system components that support the HPCI system pressure boundary are reviewed with the high pressure coolant injection system (Section 2.3.2.4). Valves associated with the standby gas treatment system loop seal are reviewed with the standby gas treatment system (Section 2.3.2.6).

Extraction Steam

The purpose of the extraction steam (ES) system is to increase steam plant efficiency by preheating incoming feedwater and thereby reducing the reactor plant heat load. Steam is conducted from main turbine connections to the two parallel feedwater heater strings to preheat the feedwater.

Reactor Feedwater

The purpose of the reactor feedwater (RF) system is to provide a dependable supply of feedwater to the reactor. The RF system consists of two parallel trains, each with a one-half capacity turbine driven reactor feed pump with associated piping and valves. Feedwater piping conducts water from outside primary containment to the reactor vessel, where it is distributed by feedwater spargers.

Each reactor feed pump is a single-stage, horizontal, centrifugal unit, operating in series with the condensate and condensate booster pumps. The motive steam for the drive turbines is normally supplied by low pressure extraction steam from the moisture separators.

The HPCI and RCIC systems inject water into the reactor vessel via feedwater piping and spargers.

The RF system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide a flow path for HPCI and RCIC to the reactor vessel.
- Support primary containment isolation.
- Maintain integrity of reactor coolant pressure boundary.

The RF system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR50.48) (support HPCI and RCIC operation).
- Perform a function that demonstrates compliance with the Commission’s regulations for station blackout (10 CFR 50.63) (support HPCI and RCIC operation).

ASME Class 1 components in the RF system are reviewed with the reactor coolant pressure boundary (Section 2.3.1.3). Class 1 components perform the 10 CFR 54.4(a)(1) and (a)(3) functions for the RF system.

Reactor Feedwater Pump and Turbine Lube Oil

The purpose of the reactor feedwater pump and turbine lube oil (RFLO) system is to provide lubricating and hydraulic fluid to the feed pump bearings, turbine bearings, and the stop and nozzle valve assemblies.

Turbine Generator

The purpose of the turbine generator (TG) system is to receive steam from the boiling water reactor, economically convert a portion of the thermal energy contained in the steam to electric energy, and provide extraction steam and moisture for feedwater heating. The system consists of the turbine, generator, exciter, controls and supporting subsystems.

The turbine-generator has two low pressure turbines, with each low pressure turbine containing six discs shrunk on a shaft with three discs per flow. The low pressure turbine casing is designed to prevent rupture due to disc failure at 120 percent design overspeed conditions.

The TG system has the following additional intended function for 10 CFR 54.4(a)(2).

- Provide a missile barrier by preventing turbine casing rupture due to disc failure.

The turbine casing is included in the 10 CFR 54.4(a)(2) review.

Turbine Generator EH Fluid

The purpose of the turbine generator EH fluid (TGF) system is to provide the hydraulic fluid used to operate the main turbine system valves during normal and emergency operations. The system includes pumps, accumulators, heat exchangers, a tank, strainer and associated valves and piping.

Turbine Generator Lube Oil

The purpose of the turbine generator lube oil—mech (LO) system is to lubricate the journal bearings and thrust bearing associated with the main turbine and the generator and with the EH system. The system also provides trip protection to the main turbine.

The LO system includes pumps, a storage tank, oil reservoirs, oil conditioner, and filters with associated piping and valves.

Turbine Lube Oil – Instruments

The purpose of the turbine lube oil—instruments (LOGT) system is provide for the testing and status indication of the turbine-generator lube oil system. The system consists mainly of EIC components with the exception of the valves associated with the EIC components.

USAR References

The following table lists the USAR references for systems described in this section.

System	USAR Section
Circulating Water	Section XI-6.0
Condensate Drains	Section XI-8.0 describes the condensate and feedwater system; Section XI-4.0 discusses the turbine sealing system.
Condensate Filter Demineralizer	Section XI-7.0
Condensate Makeup	Section XI-9.0
Extraction Steam	None (extraction steam is mentioned in Section XI-2.0 but not described.)
Turbine Generator Lube Oil	None
Turbine Lube Oil – Instruments	None
Reactor Feedwater	Sections IV-11.0 and XI-8.0
Reactor Feedwater Pump and Turbine Lube Oil	None
Turbine Generator	Section XI-2.0
Turbine Generator EH Fluid	Sections VII-11.0 and XI-2.0

Components Subject to Aging Management Review

For structural support, components subject to aging management review are those nonsafety-related components connected to safety-related components up to the first seismic anchor or base-mounted component. Scope was typically determined by the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a base-mounted component, flexible connection, or the end of a piping run (such as a vent or drain line).

For spatial interaction, auxiliary system components containing oil, steam, or liquid and located in spaces containing safety-related equipment are subject to aging management review in this 54.4(a)(2) review if not already included in another system review. Components are excluded from review if their location is such that no safety function can be impacted by component failure. If a HELB analysis assumes that nonsafety-related piping in an S&PC system does not fail or assumes failure only at specific locations, then that piping is within the scope of license renewal per 10 CFR 54.4(a)(2). Appropriate components are subject to aging management review to provide reasonable assurance that those analysis assumptions remain valid through the period of extended operation.

Series 2.3.4-2-xx tables list the component types for S&PC systems that require aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Series 3.4.2-2-xx tables provide the results of the aging management review for S&PC systems for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Table 2.3.4.2-B
Auxiliary Systems 10 CFR 54.4(a)(2) Aging Management Review Tables

System Name	Series 2.3.4-2-xx Table	Series 3.4.2-2-xx Table
Circulating Water	Table 2.3.4-2-1	Table 3.4.2-2-1
Condensate Drains	Table 2.3.4-2-2	Table 3.4.2-2-2
Condensate Filter Demineralizer	Table 2.3.4-2-3	Table 3.4.2-2-3
Condensate Makeup	Table 2.3.4-2-4	Table 3.4.2-2-4
Extraction Steam	Table 2.3.4-2-5	Table 3.4.2-2-5
Turbine Generator Lube Oil	Table 2.3.4-2-6	Table 3.4.2-2-6
Turbine Lube Oil – Instruments	Table 2.3.4-2-7	Table 3.4.2-2-7
Main Condensate	Table 2.3.4-2-8	Table 3.4.2-2-8
Main Steam	Table 2.3.4-2-9	Table 3.4.2-2-9
Reactor Feedwater	Table 2.3.4-2-10	Table 3.4.2-2-10
Reactor Feedwater Pump and Turbine Lube Oil	Table 2.3.4-2-11	Table 3.4.2-2-11
Turbine Generator	Table 2.3.4-2-12	Table 3.4.2-2-12
Turbine Generator EH Fluid	Table 2.3.4-2-13	Table 3.4.2-2-13

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings.

Table 2.3.4.2-C
LRA Drawings for S&PC Systems in Scope
for 10 CFR 54.4(a)(2) for Physical Interactions

System	Drawing Numbers	
Condensate Drains	LRA-2003 LRA-2005-SH01 LRA-2007	LRA-2008-SH01 LRA-2008-SH02 LRA-2009
Condensate Filter Demineralizer	LRA-2049-SH04	
Condensate Makeup	LRA-2004-SH01 LRA-2004-SH02 LRA-2029 LRA-2037	LRA-2042-SH03 LRA-2049-SH02 LRA-2049-SH03 LRA-2049-SH04
Circulating Water	LRA-2006-SH02 LRA-2006-SH03 LRA-2006-SH05	
Extraction Steam	LRA-2002-SH02 LRA-2003	
Turbine Generator Lube Oil	LRA-2011-SH01	
Turbine Lube Oil – Instruments	None	
Main Condensate	LRA-2003 LRA-2004-SH01 LRA-2004-SH02	LRA-2004-SH03 LRA-2005-SH01
Main Steam	LRA-2002-SH01 LRA-2002-SH02 LRA-2002-SH03	LRA-2005-SH01 LRA-2028 LRA-2041
Reactor Feedwater	LRA-2002-SH02 LRA-2004-SH01 LRA-2004-SH03	LRA-2005-SH01 LRA-2043 LRA-2044
Reactor Feedwater Pump and Turbine Lube Oil	LRA-2011-SH01	

Table 2.3.4.2-C (Continued)
LRA Drawings for S&PC Systems in Scope
for 10 CFR 54.4(a)(2) for Physical Interactions

System	Drawing Numbers
Turbine Generator	LRA-2002-SH03 LRA-2003
Turbine Generator EH Fluid	None

Table 2.3.4-1
MSIV Leakage Pathway
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Condenser	Plateout
Expansion joint	Plateout
Flow element	Pressure boundary
Piping	Pressure boundary
Restriction orifice	Pressure boundary
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

Table 2.3.4-2-1
Circulating Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-2
Condensate Drains System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Restriction orifice	Pressure boundary
Sight glass	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-3
Condensate Filter Demineralizer System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-4
Condensate Makeup System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Flow indicator	Pressure boundary
Instrument snubber	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

**Table 2.3.4-2-5
Extraction Steam System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Piping	Pressure boundary
Restriction orifice	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-6
Turbine Generator Lube Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Demister	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary
Flexible connection	Pressure boundary
Flow indicator	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Restriction orifice	Pressure boundary
Separator	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-7
Turbine Lube Oil – Instruments System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Restriction orifice	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-8
Main Condensate System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-9
Main Steam System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Flow element	Pressure boundary
Moisture separator (shell)	Pressure boundary
Piping	Pressure boundary
Restriction orifice	Pressure boundary
Rupture disk	Pressure boundary
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-10
Reactor Feedwater System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-11
Reactor Feedwater Pump and Turbine Lube Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

**Table 2.3.4-2-12
Turbine Generator System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function(s)[1]
Bolting	Pressure boundary
Piping	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Turbine casing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

Table 2.3.4-2-13
Turbine Generator EH Fluid System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function(s)[1]
Accumulator	Pressure boundary
Bolting	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

1. For component types included under 10 CFR 54.4(a)(2), the intended function of pressure boundary includes providing structural/seismic support for components that are included for nonsafety-related SSCs directly connected to safety-related SSCs.

2.4 SCOPING AND SCREENING RESULTS: STRUCTURES

Structures and structural components within the scope of license renewal are the reactor building and primary containment (Section 2.4.1), water control structures (Section 2.4.2), the turbine building, process facilities and yard structures (Section 2.4.3), and bulk commodities (piping and conduit supports, electrical cabinets, tank foundations, etc.) (Section 2.4.4).

2.4.1 Reactor Building and Primary Containment

Description

The reactor building houses the primary containment structure. This section includes both structures.

Reactor Building

The purpose of the reactor building is to surround the primary containment to provide secondary containment. The reactor building totally encloses the primary containment, the refueling and reactor servicing areas, the new and spent fuel storage facilities, and other reactor auxiliary systems. The reactor building serves as primary containment during reactor refueling and maintenance operations when the primary containment is open and as an additional barrier when the primary containment is functional. The reactor building provides an area for alternate shutdown capabilities.

The reactor building structure is seismic Class I, constructed of monolithic reinforced concrete floors and walls to the refueling level. A reinforced concrete mat constructed on dense structural fill extends from the bedrock surface to the mat foundation, minimizing settlement of the structure. The reactor building structural steel includes structural framing steel for platform floors and the alternate shutdown room, along with other miscellaneous components.

A biological shield wall, an integral part of the reactor building, surrounds primary containment. This reinforced concrete wall serves as the basic biological shield for the reactor building and also protects the primary containment against potential external missiles. Above the refueling level, the exterior walls consist of steel framing covered by insulated metal siding with sealed joints and insulated steel roof decking. Blowout panels consisting primarily of light-weight cellular concrete are located in the steam pipe chase blockouts of the wall separating the main steam tunnel and the turbine building. The main steam lines to the turbine generator from the reactor are housed in a reinforced concrete tunnel that enters the turbine building after passing under the adjacent reactor building. The reinforced concrete tunnel walls and roof are designed for radiation shielding. All elevated floors are reinforced concrete framing supported by the exterior walls, the biological shield wall and concrete columns bearing on large supporting beams that span over the top of the torus. Interior walls are reinforced concrete or concrete block. Exterior walls below the refuel floor provide radiation shielding and tornado protection.

The railroad car airlock is adjacent to the reactor building and provides a protected secondary containment access point for large equipment. The railroad airlock is a Class II structure with 12-inch thick concrete walls and roof. The airlock consists of a pair of gasketed swing doors at the exterior and a pair of gasketed missile-proof swing doors between the airlock and the reactor building. The interior door is contained in the reactor building structure and is the qualified secondary containment boundary. The exterior doors perform a secondary boundary function when the interior doors are opened to maintain secondary containment integrity. A flexible seal in the gap between the airlock and the reactor building assures secondary containment integrity.

The spent fuel storage pool, reactor cavity, and dryer separator pit in the reactor building consist of reinforced concrete lined with stainless steel plate, providing a leak-proof membrane. The pool liner is seam-welded stainless steel with pipe sleeves welded to the liner plate on both sides of the plate. A drain system between the liner and concrete structure provides for monitoring of the spent fuel pool liner for leaks. The spent fuel storage racks consist of welded assemblies of individual aluminum or stainless steel storage cells. In addition to spent fuel, new fuel is stored in the spent fuel pool in adjacent racks constructed of aluminum.

The new fuel storage vault, located in the reactor building, is integral with the reactor building concrete design and provides for storage of new fuel. However, it is not used for new fuel storage.

The refueling bridge is the principal means of transporting fuel assemblies between the reactor cavity and the spent fuel storage pool. The steel platform travels on steel tracks along each side of the reactor cavity and spent fuel storage pool. The reactor building crane is an electric motor-driven overhead crane controlled from a transversing cab. The crane is equipped with hold-down devices to prevent its being displaced from the rails and falling from the supporting structure.

The reactor building has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide shelter, support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal. The reactor building houses equipment credited in the Appendix R safe shutdown analysis, for fire protection (10 CFR 50.48), for anticipated transients without scram (10 CFR 50.62), for station blackout (10 CFR 50.63), and for environmental qualification (10 CFR 50.49).
- Provide radiation-shielding barriers to off-site radiation exposure.
- Provide secondary containment to limit the release of radioactive materials so that off-site doses from a postulated design basis accident are below the guideline values of 10 CFR 100.
- Provide primary containment to limit the release of radioactive materials so that offsite doses from a postulated refueling accident are below the guideline values of 10 CFR 50.67.
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.

Primary Containment

The purpose of the primary containment, in conjunction with other engineered safeguards, is to limit the release of fission products in the event of a postulated design basis accident so that offsite doses do not exceed the guideline values of 10 CFR 100. The primary containment is a

Mark I low-leakage pressure suppression containment design and houses the reactor vessel, the reactor recirculating loops, and other branch connections of the reactor coolant system.

The major components of the primary containment include a drywell, a torus (or pressure suppression chamber), and the connecting vent system between the drywell and torus.

Drywell

The drywell houses the reactor vessel and associated components. The drywell is a carbon steel structure surrounded by a reinforced concrete biological shield wall. Internal structures consist of a drywell fill slab, reactor pedestal, sacrificial shield wall and its lateral support, and structural steel. The reinforced concrete fill slab in the bottom of the drywell supports the reactor pedestal and other structures and components inside the drywell. A gap separates the drywell from the reactor building reinforced concrete in the area around the cylindrical portion and the spherical portion above the support transition point at the lower radius. The reinforced concrete drywell floor contains the drywell floor drain and equipment drain sumps. The reactor pedestal is a reinforced concrete cylinder supporting the reactor pressure vessel, the sacrificial shield wall, and floor framing.

One personnel access lock is provided for access to the drywell. The lock has two gasketed doors in series. A personnel access hatch is provided on the drywell head. This hatch is bolted in place. The drywell has two equipment access hatches bolted in place. The drywell top head, the two equipment hatches, the drywell and torus manways, the control rod drive removal hatch, and the stabilizer assembly inspection ports have double-gasketed closures to maintain containment leak tightness.

The drywell design accommodates pressures and temperatures resulting from a breach of the reactor coolant pressure boundary up to and including an instantaneous circumferential break of the reactor recirculation piping and provides holdup for decay of radioactive material. When operating at power, the drywell is filled with nitrogen to preclude the presence of oxygen.

Torus

The torus is located below the drywell and encircles and contains treated (demineralized) water, which forms the suppression pool. The torus is a carbon-steel pressure vessel anchored to and supported by the reinforced concrete foundation slab of the reactor building.

Connecting Vent System

A vent system connects the drywell to the torus with vent lines that terminate below the torus water surface. The vent pipes are equipped with expansion joints to accommodate differential motion between the drywell and pressure suppression chamber.

Jet deflectors in the drywell at the entrance of each vent pipe prevent damage to the vent pipes from jet forces. In critical areas where impact from a whipping pipe might penetrate the drywell, tornado siding (shell protection panels) lines the shell. This tornado siding is made of corrugated high-strength steel with a steel plate backing.

The primary containment has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Limit the release of fission products in the event of a postulated design basis accident so that offsite doses do not exceed the guideline values of 10 CFR 100.
- Provide support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal. The primary containment houses equipment credited for anticipated transients without scram (10 CFR 50.62), in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48), for station blackout (10 CFR 50.63), and for environmental qualification (10 CFR 50.49).
- Provide heat sink for any postulated transient or accident condition in which the normal heat sink (main condenser or shutdown cooling system) is unavailable.
- Provide sufficient water to supply ECCS requirements and to refill spent fuel pool if normal makeup is not available.
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.

<u>USAR References</u>

Reactor building: Sections V-3.3.2, X-2.0, X-3.5, X-4.4, XII-3.3.2, XII-2.2, C-2.5.8

Primary containment structure: Sections V-2.0, XII-2.2.14, IV-2.5, X-3.6.2

<u>Components Subject to Aging Management Review</u>

Structural commodities are structural members that support or protect plant equipment including system components, piping, and electrical conductors. Structural commodities that are unique to the reactor building and primary containment are included in this review. Those that are common to in-scope systems and structures (anchors, embedments, pipe and equipment supports, instrument panels and racks, cable trays, conduits, etc.) are reviewed with the bulk commodities (Section 2.4.4).

Table 2.4-1 lists the component types that require aging management review.

Table 3.5.2-1 provides the results of the aging management review.

2.4.2 Water Control Structures

Description

The water control structures consist of the intake structure, the intake structure guide wall, and a reinforced concrete discharge structure (seal well). The discharge structure has no intended functions for license renewal.

The purpose of the intake structure is to support and protect equipment that draws water from the Missouri River. The intake structure houses eight screen bays serving four circulating water (CW) pumps and one bay serving the service water (SW) pumps and fire pump.

The intake structure, which is located on the riverbank, consists of a seismic Class I reinforced concrete substructure and a seismic Class I reinforced concrete superstructure on the operating floor of the substructure. The reinforced concrete structure houses the SW pumps, fire protection pump, and associated accessories. A seismic Class II steel superstructure encloses the remainder of the operating floor, which contains the CW pumps and associated accessories.

Within the intake structure is an ice control tunnel and CW supply tunnel (i.e., intake tunnel). The ice control tunnel, which receives warm water from CW discharge, prevents build-up of ice on racks and traveling screens. The CW pumps discharge into the CW supply tunnel. Traveling screens and trash racks in the intake structure prevent debris from entering the CW and SW bays.

Pump baffle plates located in the service water bay provide separation of the service water pumps. Sluice gates isolate and control warm recirculated water that enters the ice control tunnel from the CW discharge. In addition, a sluice gate is installed between the circulating water bay and the service water bay to provide a suction path for the service water pumps if the inlet to service water bay should become clogged. This gate also provides a mechanism to allow maintenance for SW bay inlet components. The intake structure is provided with a crane for equipment maintenance.

A concrete skirt (foundation mat), plus sheet piling down to bedrock, is installed along the river face as an integral part of the bottom slab. Rip-rap is provided in front of the intake structure along the foundation mat of the forebay and along adjoining banks to supplement the skirt. The rip-rap and sheet piling provide scour protection. A separate slab is also provided for the SW piping that exits the river at the entrance to the discharge flume.

The reinforced concrete superstructure provides fire protection and missile protection for the service water pumps, fire protection pump, and related accessories. Steel framing with metal roof decking encloses this concrete superstructure and the remainder of the operating floor. The steel superstructure is enclosed by metal siding, with louvers, which is designed to blow off during a tornado.

The intake structure is provided with a guide wall to reduce sediment buildup. The seismic Class II guide wall, constructed of steel sheet piling, is located in front of the intake structure and runs parallel to the intake structure. A removable gate in the guide wall provides a secondary flow path during the non-navigational season. Rip-rap protection at the riverward face is provided to guard against scour of the river bed.

The intake structure has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide a flowpath for cooling water from the Missouri River or safety-related and nonsafety-related cooling water systems.
- Provide support, shelter and protection for equipment credited in the Appendix R safe shutdown capability analysis and for fire protection (10 CFR 50.48).
- Maintain ultimate heat sink.
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.

USAR References

Section XII-2.2.7

Components Subject to Aging Management Review

Structural commodities are structural members that support or protect plant equipment including system components, piping, and electrical conductors. Structural commodities that are unique to the water control structures are included in this review. Those that are common to in-scope systems and structures (anchors, embedments, equipment supports, instrument panels, racks, cable trays, and conduits, etc.) are reviewed with the bulk commodities (Section 2.4.4).

Table 2.4-2 lists the component types that require aging management review.

Table 3.5.2-2 provides the results of the aging management review.

2.4.3 Turbine Building, Process Facilities and Yard Structures

Description

The following structures are included in this evaluation.

- Turbine Building
- Process Facilities
  - Augmented Radwaste Building
  - Control Building
  - Controlled Corridor
  - Diesel Generator Building
  - Multi-Purpose Facility
  - Off-Gas Filter and Fan Building
  - Office Building (or Administration Building) (Admin)
  - Oil Tank Bunker
  - Radwaste Building
- Yard Structures
  - Control House, 161 kV Switchyard
  - Elevated Release Point (ERP) Tower
  - Fire Protection Pumphouse
  - Fire Protection Water Tanks Foundation
  - Liquid Nitrogen Tank Foundation
  - Manholes and Duct Banks
  - Transformer and Switchyard Support Structures and Foundations
  - Transmission Towers and Foundations

Turbine Building

The turbine building houses the turbine-generator and associated auxiliaries. The water treatment area, machine shop, exhaust fan room, and heating boiler room, which provide support for the power supply for the Z Sump system, are located adjacent to the turbine building and are referred to as turbine building appendages.

The turbine building consists of reinforced concrete exterior walls up to the operating floor. Above the turbine building operating floor and the service area appendages is an exterior wall of structural steel framing with metal siding and built-up roofing. The superstructure housing also supports the turbine building crane and miscellaneous monorails within the structure. Interior walls are reinforced concrete or masonry block designed to provide radiation shielding and fire protection as required to protect plant personnel and equipment. A concrete shield wall surrounds the turbine-generator. The turbine pedestal is a reinforced concrete structure supported by the same foundation mat as the building.

The turbine building has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal. The turbine building houses equipment credited for fire protection (10 CFR 50.48).
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.
- Provide functional support and protection for safety-related equipment within the scope of license renewal performed by the Z Sump system. The turbine building appendages outer wall supports the power supply for Z Sump system.

Process Facilities

The following in-scope buildings and structures identified as process facilities are included in this evaluation.

Augmented Radwaste Building

The augmented radwaste building houses the various components of the augmented radwaste system as well as the instrumentation and control systems for the augmented radwaste system. However, CNS no longer uses this system to process liquid radwaste. The building is a reinforced concrete structure founded on compacted fill. A heavy polyvinyl/chloride membrane is placed under the structural base slab and extends to the construction joint between the slab and the exterior walls. The interior floors are reinforced concrete supported on concrete walls and columns. The interior walls are of concrete and concrete block construction and also provide radiation shielding. The building contains no safety-related components. The building contains fire protection system water piping that is credited in the fire hazards analysis.

This structure has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The structure has the following intended function for 10 CFR 54.4(a)(3).

- Provide shelter or protection to components credited for fire protection (10 CFR 50.48).

Control Building

The control building houses instrumentation and switches required for station operation. Also located in this building are the main control room, a computer room, station batteries, residual heat removal service water, service air, two 50,000-gallon emergency condensate storage tanks (located in the basement), and components of the reactor protection system. A steel monorail is installed in the control building basement above the residual heat removal service water booster pumps.

The control building is a reinforced concrete structure.

The structure has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide functional support as a habitable environment for the operators in the control room post-accident.
- Provide shelter and protection for safety-related and nonsafety-related equipment.
- Provide support, shelter and protection for control room building components credited in the Appendix R safe shutdown capability analysis (10 CFR 50.48), for anticipated transients without scram (10 CFR 50.62), and for SBO (10 CFR 50.63).

Controlled Corridor

The controlled corridor is a common structure adjacent to but separate from the reactor building, turbine building, and control building. The controlled corridor houses the cable expansion room, through which the majority of the control, power and instrumentation cables are routed between the cable spreading room of the control building and the reactor building.

The controlled corridor is a reinforced concrete structure founded on compacted structural fill.

The structure has the following intended functions for 10 CFR 54.4(a)(1) and (a)(3).

- Provide shelter and protection for safety-related equipment.
- Provide support, shelter and protection for controlled corridor components credited in the Appendix R safe shutdown capability analysis (10 CFR 50.48), for anticipated transients without scram (10 CFR 50.62), and for SBO (10 CFR 50.63).

The structure has no intended functions for 10 CFR 54.4(a)(2).

Diesel Generator Building

The diesel generator building houses two diesel generators with associated equipment including diesel day tanks, air filters, silencers, exhaust stack, and all necessary electrical equipment. An exhaust stack, located on the roof, provides an elevated release point for the exhaust gas of the diesel generator engine; however, this stack is nonessential and is not Class IS.

The building is a reinforced concrete structure. The building foundation consists of wall footings on consolidated fill. The diesel generators rest upon individual concrete foundations, separated from the building foundation. In order to perform system maintenance, a monorail system is located in the diesel generator rooms above diesel generators 1A and 1B.

The structure has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal. The diesel generator building houses equipment (emergency diesel generators) credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48).
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.

Multi-Purpose Facility

The multi-purpose facility houses fire protection equipment used to meet 10 CFR 50.48 requirements for fire protection and other support equipment used in the maintenance and repair of plant components. A seismic isolation joint between the multi-purpose facility and the control building and radwaste building prevents interaction during seismic events. The building consists of structural steel framing and concrete walls with exterior metal siding and composite roofing. The foundation is supported on piles driven into the bedrock.

This structure has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

This structure has the following intended function for 10 CFR 54.4(a)(3).

- Provide shelter or protection for components credited for fire protection (10 CFR 50.48).

Off-Gas Filter and Fan Building

The off-gas filter and fan building is a prefabricated metal structure that is constructed on a reinforced concrete slab on grade. This building houses the off-gas filter pits and the off-gas dilution fans and equipment supporting the Z Sump system.

The structure has the following intended function for 10 CFR 54.4(a)(1) and (a)(2).

- Provide support and protection for equipment in support of the Z Sump system.

This structure has no intended functions for 10 CFR 54.4(a)(3).

Office Building (or Administration Building) (Admin)

The office building, also known as the administration building, provides office facilities for station personnel. A portion of the third floor extends over the top of the railroad airlock. The structure contains no safety-related components. The structure contains fire protection system water piping that is credited in the fire hazards analysis.

The structure is a multi-story reinforced concrete frame consisting of isolated column footings and grade beams supporting precast concrete wall panels. The first floor is a concrete slab on grade while the second and third floors are concrete slabs supported by concrete beams and girders. The superstructure consists of a structural steel frame work supporting a composite floor system consisting of steel decking and a concrete floor surface.

This structure has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The structure has the following intended function for 10 CFR 54.4(a)(3).

- Provide shelter or protection for components credited for fire protection (10 CFR 50.48).

Oil Tank Bunker

The oil tank bunker, located south of the machine shop, provides protection for two diesel oil storage tanks, each with its own transfer pump and piping connections to its respective fuel oil day tank.

The oil tank bunker consists of a concrete slab above the tank, crushed rock fill and a concrete retaining wall. Aluminum hatch covers located above the tanks provide access to a vault above the buried tanks.

The structure has the following intended function for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal. The oil bunker houses components (fuel oil supply tanks) credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48).
- Provide a barrier against externally generated missiles for the fuel oil tanks.

Radwaste Building

The radioactive waste building houses the various components of the radwaste system, as well as the control center for the radwaste system. The building is a reinforced concrete structure. A polyvinyl/chloride membrane is located under the structural base slab and extends to the construction joint between the slab and the exterior walls. The interior floors are reinforced concrete supported on concrete walls and columns. The interior walls are of concrete and masonry block construction and also provide radiation shielding. The building contains no safety-related equipment. The building contains fire protection system water piping that is credited in the fire hazards analysis.

The structure has no intended functions for 10 CFR 54.4(a)(1).

The structure has the following intended functions for 10 CFR 54.4(a)(2) and (a)(3).

- Provide shelter or protection for nonsafety-related equipment (plant drains components) within the scope of license renewal.
- Provide shelter or protection for components credited for fire protection (10 CFR 50.48).

<u>*Yard Structures*</u>

Control House, 161 kV Switchyard

The control house, 161 kV switchyard, houses a 125-volt DC battery system for control and protection power of the 161 kV breakers in the switchyard. The building is a concrete block structure with a composite roof supported by structural steel and metal decking.

This structure has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

This structure has the following intended function for 10 CFR 54.4(a)(3).

- Provide support and protection for nonsafety-related equipment within the scope of license renewal. The structure supports equipment (breakers) credited for station blackout (10 CFR 50.63).

Elevated Release Point (ERP) Tower

The elevated release point tower, located 350 feet southeast of the reactor building, is a free-standing steel tower supporting the vent pipe (stack) which collects, mixes, and expels gaseous radioactive by-products (including the SGT discharge) from the plant in a manner which reduces on- and off-site radiation exposure. The elevated release point discharges gases to the atmosphere from portions of the reactor building, standby gas treatment system, and the off-gas system. The structure is located such that the reactor containment and safety-related structures will not be damaged from a design basis event.

The elevated release point consists of a steel tower supported on concrete pier foundations. An instrument enclosure is located at the first platform level. This structure is a self-contained prefab metal enclosure. The Z Sump, an underground steel lined concrete tank located beneath the tower, must be capable of operating during design basis accident conditions to maintain secondary containment operability.

The elevated release point structure has the following intended functions for 10 CFR 54.4(a)(1) and (a)(2).

- Provide an elevated release point for discharge of gaseous waste products.
- Provide functional support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal performed by the Z Sump system.

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.

The elevated release point structure has no intended functions for 10 CFR 54.4(a)(3).

Fire Protection Pumphouse

The fire protection pumphouse houses the electric motor-driven fire pump and the diesel-driven fire pump along with the associated equipment for ensuring an adequate source of firewater is available.

The structure is a reinforced concrete and concrete block wall construction with a concrete roof slab. The foundation is a reinforced concrete slab on compacted granular structural fill.

The structure has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The structure has the following intended function for 10 CFR 54.4(a)(3).

- Maintain integrity of nonsafety-related structural components credited for fire protection (10 CFR 50.48).

Fire Protection Water Tanks Foundation

The fire water supply is stored in two 500,000 gallon capacity tanks. These tanks are vented to atmosphere and provide clean fire water to the electric motor-driven pump and a diesel-driven pump. Each tank is supported on a reinforced concrete foundation on compacted granular structural fill.

The fire protection water tanks foundation has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The fire protection water tanks foundation has the following intended function for 10 CFR 54.4(a)(3).

- Provide support for equipment credited for fire protection (10 CFR 50.63).

Liquid Nitrogen Tank Foundation

The purpose of the liquid nitrogen tank foundation is to provide structural support to the nitrogen tank to ensure its availability for safe shutdown following a fire. Nitrogen is used to inert primary containment and to provide instrument air loads inside primary containment during normal operations. After a fire, nitrogen serves as a backup to instrument air system accumulators inside primary containment as needed to assure proper valve operation inside primary containment.

The tank is supported by a reinforced concrete slab on compacted granular structural fill. The structure is nonsafety-related.

The structure has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The structure has the following intended functions for 10 CFR 54.4(a)(3).

- Provide structural support of nonsafety-related structural component credited in the Appendix R safe shutdown capability analysis (10 CFR 50.48).

Manholes and Duct Banks

Manholes, manhole covers, and duct banks exist in the CNS yard to allow underground routing of cables and piping.

These structures have the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide support and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal.
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.
- Provide shelter or protection for cable 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).

Transformer and Switchyard Support Structures and Foundations

The offsite power sources required to support recovery of offsite power following an SBO are the 69 kV and 161 kV power sources. The primary offsite power source, which is the 161 kV power source, supplies the station busses via circuit breakers located in the 161 kV switchyard and the startup station service transformer located in the transformer yard. The 69 kV substation breakers to the emergency station service transformer (ESST) supply the CNS alternate offsite power source. Station service transformers (normal and backup) and the 480 V transfer switch located in the 345 kV switchyard supply 480 V power to power panel PC1 in the 161 kV switchyard control house, which provides the control power for the 161 kV breakers.

The purpose of the these structures is to provide physical support to the startup and emergency station service transformers and the other transformer and switchyard components in the SBO offsite power recovery path. These support structures include the transformer foundations and foundations for the associated transformer and switchyard breakers, switchyard bus, and fused disconnect.

The NRC has required that systems and structures relied upon to restore offsite AC power (including the on-site portion of the offsite power sources) and on-site AC power be included within the license renewal scope for SBO (10 CFR 50.63). Therefore, the transformers and supporting structures are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3).

The 12.5 kV north switchgear and transformer, which supplies power to the electric fire pump, is required for 10 CFR 50.48.

The transformer and switchyard support structures and foundations have no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

These structures have the following intended function for 10 CFR 54.4(a)(3).

- Provide support for equipment credited for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63).

Transmission Towers and Foundations

The offsite power sources that support SBO recovery are the sources fed through the startup station service transformer or the emergency station service transformer. Specifically, the preferred offsite path includes the 161 kV switchyard circuit breakers, the startup station service transformer, the circuit breaker–to–transformer and transformer–to–on-site electrical distribution interconnections, and the associated control circuits and structures. The secondary offsite path includes the 69 kV switchyard circuit breakers, the emergency station service transformer, the circuit breaker-to-transformer and transformer–to–on-site electrical distribution interconnections, and the associated control circuits and structures.

The purpose of the transmission towers is to provide physical support to the transmission lines in the SBO recovery path. The 161 kV transmission towers are of galvanized steel supported on a reinforced concrete foundation or wooden utility tower made of treated wood poles. These towers support the 161 kV lines from the 1604/1606 breakers to the station startup system transformers (SSST) used for offsite power recovery. Additionally, wooden utility towers, wooden utility poles and galvanized steel structures with concrete foundations support the 69 kV line providing support for the offsite power paths.

The NRC has required that systems and structures relied upon to restore offsite AC power (including the on-site portion of the offsite power sources) and on-site AC power be included within the license renewal scope for SBO (10 CFR 50.63). Therefore, the transmission towers are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3) as are the wooden utility poles that provide support for the 69 kV line to the 69 kV substation breakers.

The transmission towers (and utility poles) have no intended functions for (10 CFR 54.4(a)(1) or (a)(2).

The transmission towers (and utility poles) have the following intended function for 10 CFR 54.4(a)(3).

- Provide support for equipment credited for station blackout (10 CFR 50.63).

<u>USAR References</u>

<u>Turbine building</u>

Section XII-2.2.2	Section XII-2.3.5.1.9

<u>Process facilities</u>

Sections IX-2.6 and XII-2.2.10	Section XII-2.2.9
Section XII-2.2.3	Section XII-2.2.12
Section VIII-2.2.5	Section XII-2.2.8
Section XII-2.2.11	Section VIII-5.4
Section XII-2.2.5	Section XII-2.2.4

<u>Yard structures</u>

Section XII-2.2.6	Section VIII-2.2.5 (discusses the transformer and switchyard system function)
Section X-9.3.2	Sections V-2.3.8.2 and X-12.3.3.2 (discuss nitrogen inerting)

<u>Components Subject to Aging Management Review</u>

Structural commodities are structural members that support or protect plant equipment including system components, piping, and electrical conductors. Structural commodities that are unique to the turbine building, process facilities and yard structures are included in this review. Those that are common to in-scope systems and structures (anchors, embedments, equipment supports, instrument panels, racks, cable trays, and conduits, etc.) are reviewed with the bulk commodities (Section 2.4.4).

Table 2.4-3 lists the component types that require aging management review.

Table 3.5.2-3 provides the results of the aging management review.

2.4.4 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 (Sections 2.4.1 through 2.4.3). Bulk commodities common to in-scope SSCs (anchors, embedments, pipe and equipment supports, instrument panels and racks, cable trays, and conduits, etc.) are addressed in this section as well as seismic II/I supports.

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) include the following.

- Provide support, shelter and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal.
- Provide support and protection for 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).
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.

Insulation may have the specific intended functions of (1) controlling the heat load during design basis accidents in areas with safety-related equipment, or (2) maintaining integrity such that falling insulation does not damage safety-related equipment (reflective metallic type reactor vessel insulation).

USAR References

None

Components Subject to Aging Management Review

Bulk commodities subject to aging management review are structural components or commodities that perform or support intended functions of in-scope SSCs. Bulk commodities unique to a specific structure are addressed in the aging management review for that structure. Bulk commodities common to in-scope SSCs (anchors, embedments, pipe and equipment supports, instrument panels and racks, cable trays, conduits, etc.) are included in this evaluation. Insulation is subject to aging management review if it performs an intended function as described above as well as seismic II/I supports.

Table 2.4-4 lists the component types that require aging management review.

Table 3.5.2-4 provides the results of the aging management review.

Table 2.4-1
Reactor Building and Primary Containment
Components Subject to Aging Management Review

Component	Intended Function[1]
Steel and Other Metals	
CRD removal hatch	Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
CRD shootout steel	Shelter or protection
Drywell equipment hatches	Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
Drywell head	Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
Drywell head access hatch	Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
Drywell personnel access lock	Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
Drywell shell	Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
Drywell shell protection panels and jet deflectors	Missile barrier Support for Criterion (a)(1) equipment
Drywell stabilizer supports	Support for Criterion (a)(1) equipment
Drywell sump liner	Shelter or protection Support for Criterion (a)(1) equipment

Table 2.4-1
Reactor Building and Primary Containment
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Drywell to torus vent line bellows	Pressure boundary Support for Criterion (a)(1) equipment
Drywell to torus vent system	Pressure boundary Support for Criterion (a)(1) equipment
Metal siding	Pressure boundary Shelter or protection
Monorails	Support for Criterion (a)(2) equipment
Personnel airlock, equipment hatch, CRD hatch and drywell head bolting	Pressure boundary Support for Criterion (a)(1) equipment
Primary containment electrical penetrations	Pressure boundary Support for Criterion (a)(1) equipment
Primary containment mechanical penetrations (includes those with bellows)	Pressure boundary Support for Criterion (a)(1) equipment
Railroad airlock doors	Fire barrier Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
Reactor building crane, rails and girders	Support for Criterion (a)(2) equipment
Reactor building loop seal drain caps	Pressure boundary Support for Criterion (a)(2) equipment
Reactor building sump liner and penetrations	Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
Reactor cavity liner	Shelter or protection Support for Criterion (a)(1) equipment
Reactor vessel stabilizer assembly	Support for Criterion (a)(1) equipment
Reactor vessel support assembly	Support for Criterion (a)(1) equipment
Refueling bridge equipment assembly	Support for Criterion (a)(2) equipment

Table 2.4-1
Reactor Building and Primary Containment
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Sacrificial shield wall lateral supports	Missile barrier Shelter or protection Support for Criterion (a)(1) equipment
Sacrificial shield wall (steel portion)	Missile barrier Shelter or protection Support for Criterion (a)(1) equipment
Spent fuel pool liner plate	Shelter or protection Support for Criterion (a)(1) equipment
Spent fuel pool gate	Shelter or protection Support for Criterion (a)(1) equipment
Spent fuel pool storage racks	Support for Criterion (a)(1) equipment
Structural steel: beams, columns and plates	Fire barrier Missile barrier Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment,
Torus electrical penetrations	Pressure boundary Support for Criterion (a)(1) equipment
Torus external supports (saddles, columns)	Support for Criterion (a)(1) equipment
Torus manway cover	Pressure boundary Support for Criterion (a)(1) equipment
Torus mechanical penetrations	Pressure boundary Support for Criterion (a)(1) equipment
Torus ring girder	Support for Criterion (a)(1) equipment
Torus shell	Heat sink Pressure boundary Support for Criterion (a)(1) equipment
Torus thermowells	Pressure boundary Support for Criterion (a)(1) equipment
Vent header support	Support for Criterion (a)(1) equipment

Table 2.4-1
Reactor Building and Primary Containment
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Concrete	
Beams, columns, floor slabs, and interior walls	Fire barrier Flood barrier Missile barrier Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Biological shield wall	Missile barrier Shelter or protection Support for Criterion (a)(1) equipment
Blowout panels (east end of steam tunnel)	Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment
Drywell fill slab	Support for Criterion (a)(1) equipment
Drywell sumps	Support for Criterion (a)(1) equipment
Exterior walls	Fire barrier Flood barrier Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Exterior walls (below grade)	Flood barrier Missile barrier Pressure boundary Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

Table 2.4-1
Reactor Building and Primary Containment
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Foundation	Flood barrier Pressure boundary Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Masonry walls	Fire barrier Missile barrier Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
New fuel storage vault	Missile barrier Shelter or protection Support for Criterion (a)(2) equipment
Reactor building sump structure	Support for Criterion (a)(1) equipment
Reactor cavity floor and wall	Shelter or protection Support for Criterion (a)(1) equipment
Reactor pedestal	Support for Criterion (a)(1) equipment
Shield plugs	Shelter or protection Support for Criterion (a)(1) equipment
Spent fuel pool floor and wall	Missile barrier Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Steam tunnel	Fire barrier Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Other materials	
Moisture barrier	Shelter or protection Support for Criterion (a)(1) equipment
Primary containment electrical penetration seals and sealant	Pressure boundary Support for Criterion (a)(1) equipment

Table 2.4-1
Reactor Building and Primary Containment
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Rubber seal for railroad airlock doors	Pressure boundary Support for Criterion (a)(1) equipment

1. Intended functions are defined in Table 2.0-1.

Table 2.4-2
Water Control Structures
Components Subject to Aging Management Review

Component	Intended Function[1]
Steel and Other Metals	
Guide wall	Shelter or protection
Pump baffle plates	Support for Criterion (a)(2) equipment
Structural steel, beams, columns, and plates	Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Traveling screen casing and associated framing	Support for Criterion (a)(2) equipment
Concrete	
Beams, columns, floor slabs and walls (above grade)	Fire barrier Heat sink Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Beams, columns, floor slabs and walls (below grade)	Heat sink Support for Criterion (a)(1) equipment, Support for Criterion (a)(2) equipment
Exterior walls above grade	Fire barrier Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Exterior walls below grade	Heat sink Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Foundation	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

Table 2.4-2
Water Control Structures
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Roof hatches	Fire barrier Missile barrier Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Roof slab	Fire barrier Missile barrier Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
SW pipe slab	Support for Criterion (a)(2) equipment

1. Intended functions are defined in Table 2.0-1.

Table 2.4-3
Turbine Building, Process Facilities and Yard Structures
Components Subject to Aging Management Review

Component	Intended Function[1]
Steel and Other Metals	
Blowout panels	Support for Criterion (a)(2) equipment
Control room ceiling support system	Support for Criterion (a)(2) equipment
Crane rails and girders	Support for Criterion (a)(2) equipment
Diesel fuel tank hatch cover	Missile barrier Shelter or protection Support for Criterion (a)(1) equipment
ERP tower	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Monorails	Support for Criterion (a)(2) equipment
Roof decking	Fire barrier Support for Criterion (a)(3) equipment
Structural steel: beams, columns, plates	Missile barrier Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Sumps liner	Support for Criterion (a)1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Transmission tower	Support for Criterion (a)(3) equipment
Concrete	
Beams, columns, floor slabs and interior walls	Fire barrier Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

Table 2.4-3
Turbine Building, Process Facilities and Yard Structures
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Diesel fuel tank retaining wall and slab	Missile barrier Shelter or protection Support for Criterion (a)(1) equipment
Duct banks	Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Exterior walls	Fire barrier Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Exterior walls (below grade)	Flood barrier Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Foundations	Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Manholes	Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Masonry walls (fire barriers)	Fire barrier Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

Table 2.4-3
Turbine Building, Process Facilities and Yard Structures
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Masonry walls	Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Roof slabs	Fire barrier Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Sumps	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Turbine shield wall	Missile barrier Shelter or protection Support for Criterion (a)(2) equipment
Other Materials	
Oil tank bunker crushed rock fill	Shelter or protection
Wooden utility poles	Support for Criterion (a)(3) equipment
Wooden utility towers	Support for Criterion (a)(3) equipment

1. Intended functions are defined in Table 2.0-1.

Table 2.4-4
Bulk Commodities
Components Subject to Aging Management Review

Component	Intended Function[1]
Steel and Other Metals	
Anchorage / embedments	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Base plates	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Battery racks	Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Cable tray	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Cable trays support	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Cardox hose reel	Support for Criterion (a)(3) equipment
Component and piping supports for ASME Class 1, 2, 3 and MC	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Component and piping supports	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Conduits	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Conduit supports	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Damper framing	Fire barrier

Table 2.4-4
Bulk Commodities
Components Subject to Aging Management Review
(Continued)

Component	Intended Function[1]
Electrical and instrument panels and enclosures	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Fire doors	Fire barrier
Fire hose reels	Support for Criterion (a)(3) equipment
Flood, pressure and specialty doors	Flood barrier Missile barrier Pressure boundary Shelter or protection
HVAC duct supports	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Instrument line supports	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Instrument racks, frames and tubing trays	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Manways, hatches, manhole covers, and hatch covers	Flood barrier Missile barrier Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Mirror insulation	Insulation Support for Criterion (a)(2) equipment
Missile shields	Missile barrier Shelter or protection
Penetration sleeves (mechanical/ electrical not penetrating PC boundary)	Flood barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment

**Table 2.4-4
Bulk Commodities
Components Subject to Aging Management Review
(Continued)**

Component	Intended Function[1]
Pipe whip restraints	Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Stairway, handrail, platform, grating, decking, and ladders	Support for Criterion (a)(2) equipment
Support members: welds, bolted connections, support anchorage to building structure	EN, SNS, SSR
Vents and louvers	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Bolted Connections	
Anchor bolts	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
ASME Class 1, 2, 3 and MC supports bolting	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Structural bolting	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Concrete	
Equipment pads/foundations	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Flood curbs	Flood barrier Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

**Table 2.4-4
Bulk Commodities
Components Subject to Aging Management Review
(Continued)**

Component	Intended Function[1]
Manways, hatches, manhole covers, and hatch covers	Fire barrier Flood barrier Pressure boundary Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Missile shields	Missile barrier
Support pedestals	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Other Materials	
Fire stops	Fire barrier
Fire wrap	Fire barrier
Flood retention materials (spare parts)	Flood barrier
Insulation	Insulation Support for Criterion (a)(2) equipment
Penetration sealant (fire, flood, radiation)	Fire barrier Flood barrier Pressure boundary Shelter or protection Support for Criterion (a)(2) equipment
Seals and gaskets (doors, manways and hatches)	Flood barrier Pressure boundary Support for Criterion (a)(1) equipment
Seismic isolation joint	Fire barrier Support for Criterion (a)(1) equipment
Water stops	Flood barrier

1. Intended functions are defined in Table 2.0-1.

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROL SYSTEMS

Description

As stated in Section 2.1.1, plant electrical and instrument and control (EIC) systems are included in the scope of license renewal as are EIC components in mechanical systems. The default inclusion of plant EIC systems in the scope of license renewal is the bounding approach used for the scoping of electrical systems.

The basic philosophy used in the EIC components IPA is that components are included in the review unless specifically screened out. When used with the plant spaces approach, this method eliminates the need for unique identification of individual components and specific component locations. This assures components are not improperly excluded from an aging management review.

The EIC IPA began by grouping the total population of components into commodity groups. The commodity groups include similar EIC components with common characteristics. Component level intended functions of the commodity groups were identified. During the IPA, commodity groups and specific plant systems were eliminated from further review as the intended functions of commodity groups were examined.

In addition to the plant electrical systems, certain switchyard components required to restore offsite power following a station blackout were conservatively included within the scope of license renewal even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63). The scoping boundaries of the offsite power system are described below.

LRA Drawing LRA-E-001-SH01 depicts the electrical interconnection between CNS and the offsite transmission network.

USAR References

Additional details for electrical systems and commodities can be found in USAR Chapters VII and VIII.

Scoping Boundaries

Plant EIC systems are included in the scope of license renewal as are EIC components in mechanical systems.

The offsite power sources required to support SBO recovery are the sources fed through the startup station service transformer (SSST) and the emergency station service transformer (ESST).

The CNS preferred offsite power source is supplied by the 161 kV switchyard breakers to the SSST. The SSST supplies power to the 4.16 kV safety buses via the 4.16 kV non-safety buses. Components in the preferred offsite power path consists of control circuit cables and connections, high voltage insulators, non-segregated bus, medium-voltage cables and connections, overhead transmission conductors and connections, switchyard bus and connections, transformers, disconnects, and circuit breakers.

The CNS alternate offsite power source is supplied by the 69 kV switchyard breakers to the ESST. The ESST supplies power to the 4.16 kV safety buses. Components in the alternate offsite power recovery path consist of control circuit cables and connections, high voltage insulators, non-segregated bus, overhead transmission conductors and connections, switchyard bus and connections, transformers, disconnects, and circuit breakers.

Structures supporting breakers, disconnects, transformers, and switchyard bus and wooden and steel transmission towers and foundations within the offsite power paths are evaluated with structures in Section 2.4.

Commodity Groups Subject to AMR

As discussed in Section 2.1.2.3.1, CNS electrical commodity groups correspond to two of the commodity groups identified in NEI 95-10. The two commodity groups are

- high voltage insulators, and
- cables and connections, bus, electrical portions of EIC penetration assemblies, fuse holders outside of cabinets of active electrical components.

The commodity group cables, connections, bus, and electrical portions of EIC penetration assemblies is further divided into the following.

- cable connections (metallic parts)
- electrical cables and connections subject to 10 CFR 50.49 EQ requirements[1]
- electrical cables and connections not subject to 10 CFR 50.49 EQ requirements
- electrical cables and connections not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits

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1. CNS electrical cables and connections subject to 10 CFR 50.49 EQ requirements are not subject to aging management review since the components are subject to replacement based on qualified life.

- EIC penetration cables and connections not subject to 10 CFR 50.49 EQ requirements[2]
- fuse holders – insulation material
- fuse holders – metallic clamps[3]
- inaccessible medium-voltage (2 kV to 35 kV) cables (e.g., installed underground in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements
- metal enclosed bus – bus/connections
- metal enclosed bus – enclosure assemblies
- metal enclosed bus – insulation/insulators
- switchyard bus and connections
- transmission conductors and connections
- uninsulated ground conductors[4]

Commodity Groups Not Subject to AMR

Fuse Holders – Metallic Clamps

Fuse holders inside enclosures of active components, such as switchgear, power supplies, power inverters, battery chargers, and circuit boards, are piece parts of the larger complex assembly, and are not subject to aging management review.

A review of CNS documents (e.g., drawings, procedures, USAR, site component database, and electrical design basis documents) identified fuse holders. This review determined if a fuse holder was part of an active component. From reviewing the fuses and associated drawings, a determination was made of whether each fuse holder was part of an active component. If not part of an active component, the fuse holder required further evaluation to determine if it was in a circuit that performed a license renewal intended function.

The review indicated that the fuse holders utilizing metallic clamps are either part of an active component or located in circuits that perform no license renewal intended function. Therefore, fuse holders with metallic clamps at CNS are not subject to aging management review.

Uninsulated Ground Conductors

A review of the CNS USAR did not identify a license renewal intended function for uninsulated ground conductors. These components are not safety-related and are not credited for mitigation

2. CNS EIC penetrations subject to 10 CFR 50.49 EQ requirements are not subject to aging management review. However, CNS has one EIC penetration not subject to 10 CFR 50.49 EQ requirements that is subject to aging management review.
3. CNS fuse holders with metallic clamps are either part of an active assembly or part of circuits that perform no license renewal intended function.
4. CNS uninsulated ground conductors limit equipment damage in the event of a circuit failure but do not perform an intended function for license renewal.

of regulated events. Industry and plant-specific operating experience (OE) for uninsulated ground conductors does not indicate credible failures that could prevent satisfactory accomplishment of a safety function; therefore, such failures are hypothetical. As discussed in Section 2.1.3.1.2 of NUREG-1800 and Section III.c(iii) of the statements of consideration (60FR22467), hypothetical failures are not required to be considered for license renewal scoping.

Table 2.5-1 lists the component types that require aging management review.

Table 3.6.2-1 provides the results of the aging management review.

Table 2.5-1
Electrical and Instrumentation and Control Systems
Components Subject to Aging Management Review

Structure and/or Component/Commodity	Intended Function[1]
Cable connections (metallic parts)	Conducts electricity
Electrical cables and connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements (includes non-EQ EIC penetration conductors and connections)	Conducts electricity
Electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits	Conducts electricity
Fuse holders (insulation material)	Conducts electricity
High voltage insulators (high voltage insulators for SBO recovery)	Insulation (electrical)
Inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	Conducts electricity
Metal-enclosed bus (non-segregated bus for SBO recovery) • bus and connections	Conducts electricity
Metal-enclosed bus (non-segregated bus for SBO recovery) • insulation/insulators	Insulation (electrical)
Metal-enclosed bus (non-segregated bus for SBO recovery) • enclosure assemblies	Support for Criterion (a)(3) equipment
Switchyard bus (switchyard bus for SBO recovery) • connections	Conducts electricity
Transmission conductors and connections (transmission conductors for SBO recovery) • connections	Conducts electricity

1. Intended functions are defined in Table 2.0-1.

3.0 AGING MANAGEMENT REVIEW RESULTS

This section provides the results of the aging management review (AMR) for structures and components identified in Section 2 as subject to aging management review. Tables 3.0-1, 3.0-2, and 3.0-3 provide descriptions of the mechanical, structural, and electrical service environments, respectively, used in the AMRs to determine aging effects requiring management.

Results of the AMRs are presented in the following two table types.

- **Table 3.x.1** where

  3 indicates the table pertaining to a Section 3 aging management review,

  x indicates the table number from NUREG-1801 (Reference 3.0-2), Volume 1, and

  1 indicates that this is the first table type in Section 3.x.

For example, in the reactor coolant system subsection, this is Table 3.1.1, and in the engineered safety features subsection, this is Table 3.2.1. For ease of discussion, these table types will hereafter be referred to as "Table 1." These tables are derived from the corresponding tables in NUREG-1801, Volume 1, and present summary information from the AMRs.

- **Table 3.x.2-y** where

  3 indicates the application section number,

  x indicates the table number from NUREG-1801, Volume 1,

  2 indicates that this is the second table type in Section 3.x, and

  y indicates the system table number.

For example, within the reactor coolant system subsection, the AMR results for the reactor vessel are presented in Table 3.1.2-1, and the results for the reactor vessel internals are in Table 3.1.2-2. In the engineered safety features subsection, the residual heat removal system results are presented in Table 3.2.2-1, and the core spray system is in Table 3.2.2-2. For ease of discussion, these table types will hereafter be referred to as "Table 2." These tables present the results of the AMRs.

TABLE DESCRIPTION

Table 1

The purpose of a Table 1 is to provide a summary comparison of how the CNS AMR results align with the corresponding table of NUREG-1801, Volume 1. These tables are essentially the same as Tables 1 through 6 provided in NUREG-1801, Volume 1, with the following exceptions.

- The “ID” column is labeled "Item Number" and the number has been expanded to include the table number.
- The "Type" column has been deleted. Items applicable to PWRs only are noted as such.
- The "Related Generic Item" and “Unique Item” columns have been replaced by a "Discussion" column.

The "Item Number" column provides a means to cross-reference to Table 1 from the Table 2s.

Information in the following columns of Table 1 is taken directly from NUREG-1801, Volume 1.

- Component
- Aging Effect/Mechanism [AEM]
- Aging Management Programs
- Further Evaluation Recommended

Further information is provided in the "Discussion" column. The Discussion column explains, in summary, how the CNS evaluations align with NUREG-1801, Volume 1. The following are examples of information that might be contained within this column:

- any "Further Evaluation Recommended" information or reference to the location of that information;
- the name of a plant-specific program being used;
- exceptions to the NUREG-1801 assumptions;
- a discussion of how the line item is consistent with the corresponding line item in NUREG-1801, Volume 1, when it may not be intuitively obvious;
- a discussion of how the line item is different than the corresponding line item in NUREG-1801, Volume 1, when it may appear to be consistent.

Table 2

Table 2s provide the results of the aging management reviews for those structures and components identified in Section 2 as being subject to aging management review. There is a Table 2 for each aging management review within a NUREG-1801 system group. For example, the engineered safety features system group contains tables specific to residual heat removal, core spray, automatic depressurization, high pressure coolant injection, reactor core isolation cooling, standby gas treatment, and primary containment penetrations.

Table 2s also provide a comparison of the AMR results with the AMR results in NUREG-1801. Comparison to NUREG-1801 Volume 2 is performed by considering the component type, material, environment, aging effect requiring management, and aging management program (AMP) listed in each Table 2 line item to determine the degree of consistency with an appropriate NUREG-1801 line item, if one exists. The comparison is documented in columns 7, 8, and 9, as discussed below.

Each Table 2 consists of the following nine columns.

Component Type

Column 1 identifies the component types from Section 2 of this application that are subject to aging management review.

The term "piping" in component lists includes pipe and pipe fittings (such as elbows and reducers).

The term "heat exchanger (shell)" may include the bonnet/channel head and tubesheet. In cases where the bonnet/channel head and tubesheet provide a unique material and environment combination, they will be uniquely identified as a separate component type.

Intended Function

Column 2 identifies the license renewal intended functions (using abbreviations where necessary) for the listed component types. Definitions and abbreviations of intended functions are listed in Table 2.0-1 in Section 2.

Material

Column 3 lists the particular materials of construction for the component type being evaluated.

Environment

Column 4 lists the environment to which the component types are exposed. Internal and external service environments are indicated using *(int)* or *(ext)*, respectively. A description of these environments is provided in Tables 3.0-1, 3.0-2, and 3.0-3 for mechanical, structural, and electrical components, respectively.

Aging Effect Requiring Management

Column 5 lists the aging effects requiring management for material and environment combinations for each component type.

Aging Management Programs (AMP)

Column 6 lists the programs used to manage the aging effects requiring management.

NUREG-1801, Vol. 2, Item

Each combination of the following factors listed in Table 2 is compared to NUREG-1801, Volume 2, to identify consistencies.

- component type
- material
- environment
- aging effect requiring management
- aging management program

Column 7 documents identified consistencies by noting the appropriate NUREG-1801, Volume 2, item number. If there is no corresponding item number in NUREG-1801, Volume 2, for a particular combination of factors, column 7 is left blank.

Comparisons of system and structure aging management results to NUREG-1801, Volume 2, items are generally within the corresponding system group and preferably within the specific system or structure. For example, aging management results for the core spray system will generally be compared to NUREG-1801, Volume 2, ESF system results in Chapter V, and preferably to items in Table V.D2 for the emergency core cooling systems for BWRs. In some cases where a particular aging management review result has no valid comparison within the system group, a comparison is made outside the system group. For example, a material, environment, aging effect, and program combination in the core spray aging management results may have no comparable item in the NUREG-1801, Volume 2, ESF system results, but a match can be found in the auxiliary systems tables.

Table 1 Item

Column 8 lists the corresponding line item from Table 1. If there is no corresponding item in NUREG-1801, Volume 1, then column 8 is left blank.

Each combination of the following that has an identified NUREG-1801, Volume 2 item number also has a Table 1 line item reference number.

- component type
- material
- environment
- aging effect requiring management
- aging management program

Notes

Column 9 contains notes that are used to describe the degree of consistency with the line items in NUREG-1801, Volume 2. Notes that use letter designations are standard notes based on

Appendix F of NEI 95-10 (Reference 3.0-3). Notes that use numeric designators are specific to the plant site.

Many of the NUREG-1801 evaluations refer to plant-specific programs. In these cases, Note E is used for correlations between the combination in Table 2 and a combination for a line item in NUREG-1801, Volume 2.

FURTHER EVALUATION REQUIRED

The Table 1s in NUREG-1801 indicate that further evaluation is necessary for certain aging effects and other issues discussed in NUREG-1800 (Reference 3.0-1). Section 3 includes discussions of these issues numbered in accordance with the discussions in NUREG-1800. The discussions explain the site's approach to these areas requiring further evaluation.

REFERENCES

3.0-1 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 1, U. S. Nuclear Regulatory Commission, September 2005.

3.0-2 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Volumes 1 and 2, Revision 1, U. S. Nuclear Regulatory Commission, September 2005.

3.0-3 NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule*, Nuclear Energy Institute (NEI), Revision 6, June 2005.

Table 3.0-1
Service Environments for Mechanical Aging Management Reviews

Environment	Description
ASME Class 1 Mechanical Environments	
Air – indoor	Indoor air. Although inerted with nitrogen, primary containment air is conservatively considered equivalent to reactor building ambient air and both are referred to as air – indoor.
Neutron fluence	Neutron flux integrated over time. Neutron fluence is specified as an environment for the limiting reactor vessel components with material properties that may be significantly affected by neutron irradiation.
Treated water	Treated or demineralized water[1]
Treated water > 140°F	Treated or demineralized water above stress corrosion cracking (SCC) threshold for stainless steel. Steam is considered treated water.
Treated water > 482°F	Treated or demineralized water above thermal embrittlement threshold for cast austenitic stainless steel (CASS). Steam is considered treated water.
Non-Class 1 Mechanical Environments	
Air – indoor	Indoor air on systems with temperatures above the dewpoint. Although inerted with nitrogen, primary containment air is conservatively considered as air – indoor.
Air – outdoor	Exposed to air and local weather conditions
Air – treated	Air that is dried and filtered
Concrete	Components embedded in concrete
Condensation	Air and condensation on surfaces of indoor systems with temperatures below the dewpoint. For exterior surfaces, condensation is considered untreated water due to potential for surface contamination.
Exhaust gas	Gas present in a diesel engine exhaust
Fuel oil	Fuel oil such as used for combustion engines, boilers, etc.
Gas	Inert gas such as carbon dioxide, Freon, Halon, nitrogen, etc.
Liquid nitrogen	Liquid nitrogen (N_2 system)
Lube oil	Lubricating oil for plant equipment
Raw water	Raw, untreated fresh water or water not treated by a chemistry program such as water collected in floor drains and sumps

Table 3.0-1 (Continued)
Service Environments for Mechanical Aging Management Reviews

Environment	Description
Sodium pentaborate solution	Sodium pentaborate solution (SLC system)
Soil	External environment for components buried in the soil, including groundwater in the soil
Steam	Treated water that has been converted to steam
Treated water	Treated or demineralized water[1]
Treated water > 140°F	Treated water above the SCC threshold for stainless steel

1. For the aging management review process, and the Table 2 presentation of review results, "treated water" encompasses a range of water types, all of which were chemically treated or demineralized. These water types include treated water, reactor coolant, and closed cycle cooling water as defined in NUREG-1801. In the Table 2 results, the type of water can normally be inferred from the context of the result (e.g., if water chemistry control – closed cooling water is the aging management program, then the treated water is equivalent to closed cycle cooling water as defined by NUREG-1801). Where such an inference is not clear, a plant-specific note identifies the water type.

   For the comparison of the aging management review results with those of NUREG-1801, as presented in the last three Table 2 columns, and for the summary of results discussed in Table 1, the NUREG-1801 definitions of water types were used. In other words, the "treated water" listed in the results was compared to the corresponding water type of NUREG-1801. The discussions in Table 1, and in the text sections referenced in Table 1 for further evaluation, use the water types defined by NUREG-1801. In these discussions, "treated water" refers only to water controlled by the Water Chemistry Control – BWR Program.

Table 3.0-2
Service Environments for Structural Aging Management Reviews

Environment	Description
Air – indoor uncontrolled	Air with temperature less than 150°F, humidity up to 100% and protected from precipitation
Air – outdoor	Exposed to the weather with air temperature less than 115°F, humidity up to 100%
Exposed to fluid environment	Fluid environment for structures at CNS is defined as raw water or treated water. • Raw water – Missouri River provides the source of raw water utilized at CNS. Raw water is also rain or ground water. Raw water is water that has not been demineralized or chemically treated to any significant extent. Raw water may contain contaminants. CNS building sumps may be exposed to a variety of untreated water that is classified as raw water for the determination of aging effects. • Treated water – Treated water is demineralized water or chemically purified water and is the base water for clean systems. Treated water could be deaerated and include corrosion inhibitors, biocides, or some combination of these treatments.
Soil	External environment for components buried in the soil, including groundwater in the soil. This environment is “non-aggressive” as defined in NUREG-1801.

Table 3.0-3
Service Environments for Electrical Aging Management Reviews

Environment	Description
Air – indoor	Indoor air on systems with temperatures higher than the dew point; i.e., condensation can occur but only rarely, equipment surfaces are normally dry.
Air – outdoor	The outdoor environment consists of moist atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation and wind. The component is exposed to air and local weather conditions. A component is considered susceptible to a wetted environment when it is submerged, has the potential to pool water, or is subject to external condensation.
Heat and air	Indoor air at normal operating temperature.
Moisture and air	Indoor air at normal operating humidity.
Moisture and voltage stress	Exposure to significant moisture (moisture that last more than a few days; e.g., cable in standing water) simultaneously with significant voltage (subjected to system voltage between 2 kV and 35 kV for more than twenty-five percent of the time)
Radiation and air	Normal plant operating radiation levels.

3.1 REACTOR VESSEL, INTERNALS AND REACTOR COOLANT SYSTEM

3.1.1 Introduction

This section provides the results of the aging management reviews for components in the reactor vessel, internals and reactor coolant system that are subject to aging management review. The following component groups are addressed in this section (component group descriptions are available in the referenced sections).

- reactor vessel (Section 2.3.1.1)
- reactor vessel internals (Section 2.3.1.2)
- reactor coolant pressure boundary (Section 2.3.1.3)

Table 3.1.1, Summary of Aging Management Programs for the Reactor Coolant System in Chapter IV of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the reactor coolant system (RCS) component groups. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.1.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for the reactor vessel, internals and reactor coolant system components.

- Table 3.1.2-1 Reactor Vessel—Summary of Aging Management Evaluation
- Table 3.1.2-2 Reactor Vessel Internals—Summary of Aging Management Evaluation
- Table 3.1.2-3 Reactor Coolant Pressure Boundary—Summary of Aging Management Evaluation

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 coolant system components. Programs are described in Appendix B. Further details are provided in Tables 3.1.2-1 through 3.1.2-3.

3.1.2.1.1 Reactor Vessel

Materials

Reactor vessel components are constructed of the following materials.

- carbon steel
- high-strength low-alloy steel
- low-alloy steel

- low-alloy steel with partial stainless steel (SS) cladding
- low-alloy steel with SS cladding
- nickel alloy
- stainless steel

Environment

Reactor vessel components are exposed to the following environments.

- air – indoor
- neutron fluence
- treated water
- treated water > 140ºF

Aging Effects Requiring Management

The following aging effects associated with the reactor vessel require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload
- reduction of fracture toughness

Aging Management Programs

The following aging management programs manage the aging effects for the reactor vessel components.

- Bolting Integrity
- BWR CRD Return Line Nozzle
- BWR Feedwater Nozzle
- BWR Penetrations
- BWR Stress Corrosion Cracking
- BWR Vessel ID Attachment Welds
- BWR Vessel Internals
- Inservice Inspection – ISI
- Reactor Head Closure Studs
- Reactor Vessel Surveillance
- Water Chemistry Control – BWR

3.1.2.1.2 Reactor Vessel Internals

Materials

Reactor vessel internals components are constructed of the following materials.

- cast austenitic stainless steel (CASS)
- nickel alloy
- stainless steel

Environment

Reactor vessel internals components are exposed to the following environments.

- air – indoor
- neutron fluence
- treated water
- treated water > 140°F
- treated water > 482°F

Aging Effects Requiring Management

The following aging effects associated with the reactor vessel internals require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload
- reduction of fracture toughness

Aging Management Programs

The following aging management programs manage the aging effects for the reactor vessel internals components.

- BWR Vessel Internals
- Inservice Inspection – ISI
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Water Chemistry Control – BWR

3.1.2.1.3 Reactor Coolant Pressure Boundary

Materials

Reactor coolant pressure boundary components are constructed of the following materials.

- carbon steel
- CASS
- stainless steel

Environment

Reactor coolant pressure boundary components are exposed to the following environments.

- air – indoor
- treated water
- treated water > 140°F
- treated water > 482°F

Aging Effects Requiring Management

The following aging effects associated with the reactor coolant pressure boundary require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload
- reduction of fracture toughness

Aging Management Programs

The following aging management programs manage the aging effects for the reactor coolant pressure boundary components.

- Bolting Integrity
- BWR Stress Corrosion Cracking
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Inservice Inspection – ISI
- One-Time Inspection
- One-time Inspection – Small-Bore Piping
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Cooling Water

3.1.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 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 CNS approach to these areas requiring further evaluation. Programs are described in Appendix B.

3.1.2.2.1 Cumulative Fatigue Damage

Fatigue is considered a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3 for the reactor vessel, selected components of the reactor vessel internals and most components of the reactor coolant pressure boundary. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of fatigue for the reactor vessel is discussed in Sections 4.3.1.1 and 4.3.1.2.

The reactor vessel internals are not part of the reactor coolant pressure boundary. Although not mandatory, fatigue analyses were performed for selected internals components. For those internals components analyzed, the evaluation of fatigue is discussed in Section 4.3.1.3. Cracking, including cracking due to fatigue, will be managed by the BWR Vessel Internals Program for other internals components.

The evaluation of the fatigue TLAA for the Class 1 portions of the reactor coolant pressure boundary piping and components, including those for interconnecting systems, is discussed in Section 4.3.1.4.

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 in steel components of the reactor pressure vessel exposed to reactor coolant is managed at CNS by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow.

2. This paragraph in NUREG-1800 pertains to BWR isolation condenser components. CNS does not have an isolation condenser; however, loss of material due to general, pitting, and crevice corrosion in other steel components within the reactor coolant pressure boundary exposed to reactor coolant is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow.

3. Loss of material due to general, pitting, and crevice corrosion in stainless steel (including CASS), nickel-alloy and steel with stainless steel clad components exposed to reactor coolant is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including areas of stagnant flow.

4. This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

1. 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. The Reactor Vessel Surveillance Program manages reduction in fracture toughness due to neutron embrittlement of reactor vessel beltline materials. CNS 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, Section XI.M31, Reactor Vessel Surveillance, including recommendations for maintaining untested capsules in storage for future reinsertion.

3.1.2.2.4 Cracking due to Stress Corrosion Cracking (SCC) and Intergranular Stress Corrosion Cracking (IGSCC)

1. The Water Chemistry Control – BWR and Inservice Inspection – ISI Programs manage cracking due to SCC and IGSCC in the stainless steel vessel flange leak detection line. The Inservice Inspection – ISI Program uses periodic pressure testing to identify cracking in the line. The One-time Inspection – Small-Bore Piping Program will verify the effectiveness of the programs. The One-Time Inspection – Small-Bore Piping Program will include the vessel flange leak-off piping when determining an inspection sample representative of all CNS small-bore piping and includes the use of volumetric examination for the detection of cracking.

2. This paragraph in NUREG-1800 pertains to BWR isolation condenser components. CNS does not have an isolation condenser, so this paragraph was not used.

3.1.2.2.5 Crack Growth due to Cyclic Loading

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.6 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement and Void Swelling

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.7 Cracking due to Stress Corrosion Cracking

Both paragraphs in NUREG-1800 apply to PWRs only.

3.1.2.2.8 Cracking due to Cyclic Loading

1. This paragraph in NUREG-1800 pertains to the jet pump sensing lines inside the reactor vessel. The lines inside the vessel do not form part of the RCS pressure boundary and their failure would not prevent the satisfactory accomplishment of any safety function. At CNS, these lines have no license renewal component intended function and thus are not subject to aging management review. However, the lines outside the vessel are part of the RCS pressure boundary and hence are subject to aging management review.

2. This paragraph in NUREG-1800 pertains to BWR isolation condenser components. As CNS does not have an isolation condenser, this paragraph was not used.

3.1.2.2.9 Loss of Preload due to Stress Relaxation

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.10 Loss of Material due to Erosion

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.11 Cracking due to Flow-Induced Vibration

Cracking due to flow-induced vibration in the stainless steel steam dryers is managed by the BWR Vessel Internals Program. The BWR Vessel Internals Program incorporates the inspection recommendations of BWRVIP-139. The Water Chemistry Control – BWR Program supplements the BWR Vessel Internals Program.

3.1.2.2.12 Cracking due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking (IASCC)

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.13 Cracking due to Primary Water Stress Corrosion Cracking (PWSCC)

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.14 Wall Thinning due to Flow-Accelerated Corrosion

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.15 Changes in Dimensions due to Void Swelling

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.16 Cracking due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

Both paragraphs in NUREG-1800 apply to PWRs only.

3.1.2.2.17 Cracking due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.18 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of CNS quality assurance procedures and administrative controls for aging management programs.

3.1.2.3 Time-Limited Aging Analyses

TLAA identified for the reactor coolant system include reactor vessel neutron embrittlement and metal fatigue. These topics are addressed in Section 4.

3.1.3 Conclusion

The reactor vessel, internals, and reactor coolant system 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 the effects for the reactor vessel, internals, and reactor coolant system components are identified in Section 3.1.2.1 and in the following tables. 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 demonstrations provided in Appendix B, the effects of aging associated with the reactor coolant system components 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 3.1.1
Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-1	Steel pressure vessel support skirt and attachment welds	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.
3.1.1-2	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.
3.1.1-3	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor coolant pressure boundary piping, piping components, and piping elements exposed to reactor coolant	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-4	Steel pump and valve closure bolting	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) check Code limits for allowable cycles (less than 7000 cycles) of thermal stress range	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.
3.1.1-5	Stainless steel and nickel alloy reactor vessel internals components	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.
3.1.1-6	PWR only				
3.1.1-7	PWR only				
3.1.1-8	PWR only				
3.1.1-9	PWR only				
3.1.1-10	PWR only				

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-11	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	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Water Chemistry Control – BWR Program, augmented by the One-Time Inspection Program to verify program effectiveness, will be used to manage loss of material in steel components of the reactor vessel. See Section 3.1.2.2.2 Item 1.
3.1.1-12	PWR only				
3.1.1-13	Steel and stainless steel isolation condenser components exposed to reactor coolant	Loss of material due to general (steel only), pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Although CNS has no isolation condenser, loss of material in other steel components within the reactor coolant pressure boundary is managed by the Water Chemistry Control – BWR Program, augmented by the One-Time Inspection Program to verify program effectiveness. See Section 3.1.2.2.2 Item 2.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-14	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	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in stainless steel, nickel alloy and steel with stainless steel clad components of the reactor vessel is managed by the Water Chemistry Control – BWR Program, augmented by the One-Time Inspection Program to verify program effectiveness. See Section 3.1.2.2.2 Item 3.
3.1.1-15	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	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in stainless steel (including CASS) and nickel alloy components exposed to reactor coolant is managed by the Water Chemistry Control – BWR Program, augmented by the One-Time Inspection Program to verify program effectiveness. See Section 3.1.2.2.2 Item 3.
3.1.1-16	PWR only				

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-17	Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 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	Loss of fracture toughness for the reactor vessel beltline shell and welds is a TLAA. There are no nozzles in the beltline region composed of ferritic materials. See Section 3.1.2.2.3 Item 1.
3.1.1-18	Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor Vessel Surveillance	Yes, plant specific	Consistent with NUREG-1801. The Reactor Vessel Surveillance Program manages reduction in fracture toughness of reactor vessel beltline materials. See Section 3.1.2.2.3 Item 2.
3.1.1-19	Stainless steel and nickel alloy top head enclosure vessel flange leak detection line	Cracking due to stress corrosion cracking and 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	The Water Chemistry Control – BWR and Inservice Inspection – ISI Programs manage cracking in the stainless steel head seal leak detection line. The One-time Inspection – Small-Bore Piping Program will verify program effectiveness. See Section 3.1.2.2.4 Item 1.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-20	Stainless steel isolation condenser components exposed to reactor coolant	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes, detection of aging effects is to be evaluated	This item was not used. CNS does not have an isolation condenser. See Section 3.1.2.2.4 Item 2.
3.1.1-21	PWR only				
3.1.1-22	PWR only				
3.1.1-23	PWR only				
3.1.1-24	PWR only				
3.1.1-25	Stainless steel jet pump sensing line	Cracking due to cyclic loading	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The jet pump instrumentation lines inside the reactor vessel are not subject to aging management review. The lines outside the vessel are part of the RCS pressure boundary and hence are subject to aging management review. These lines are included as piping and fittings < 4" NPS and cracking of these lines is addressed by item 3.1.1-48 of this table. See Section 3.1.2.2.8 Item 1.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-26	Steel and stainless steel isolation condenser components exposed to reactor coolant	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD) and plant-specific verification program	Yes, detection of aging effects is to be evaluated	This item was not used. CNS does not have an isolation condenser. See Section 3.1.2.2.8 Item 2.
3.1.1-27	PWR only				
3.1.1-28	PWR only				
3.1.1-29	Stainless steel steam dryers exposed to reactor coolant	Cracking due to flow-induced vibration	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The BWR Vessel Internals Program will manage cracking in the stainless steel steam dryers. The Water Chemistry Control – BWR Program supplements the BWR Vessel Internals Program. See Section 3.1.2.2.11.
3.1.1-30	PWR only				
3.1.1-31	PWR only				
3.1.1-32	PWR only				
3.1.1-33	PWR only				
3.1.1-34	PWR only				
3.1.1-35	PWR only				
3.1.1-36	PWR only				
3.1.1-37	PWR only				

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-38	Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant	Cracking due to cyclic loading	BWR CR Drive Return Line Nozzle	No	Consistent with NUREG-1801. The BWR CRD Return Line Nozzle Program manages cracking in the low-alloy steel with stainless steel cladding control rod drive return line nozzle exposed to reactor coolant. The Water Chemistry Control – BWR Program supplements the BWR CRD Return Line Nozzle Program.
3.1.1-39	Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	Consistent with NUREG-1801. The BWR Feedwater Nozzle Program manages cracking in the low alloy steel feedwater nozzles exposed to reactor coolant.
3.1.1-40	Stainless steel and nickel alloy penetrations for control rod drive stub tubes instrumentation, jet pump instrument, standby liquid control, flux monitor, and drain line exposed to reactor coolant	Cracking due to stress corrosion cracking, Intergranular stress corrosion cracking, cyclic loading	BWR Penetrations and Water Chemistry	No	Cracking in stainless steel, nickel alloy and steel clad with nickel-alloy nozzles and penetrations in the reactor vessel is managed by the Water Chemistry Control – BWR Program and either the BWR Penetrations, Inservice Inspection – ISI or BWR Vessel Internals Program.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-41	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 and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Cracking in stainless steel, nickel alloy and steel clad with stainless steel components in reactor coolant is managed by a combination of several programs. Consistent with NUREG-1801 for some components of the reactor vessel and reactor coolant pressure boundary, the BWR Stress Corrosion Cracking and Water Chemistry Control – BWR Programs, further supplemented by the Inservice Inspection – ISI Program for some components, manage cracking. For other components, to which the BWR Stress Corrosion Cracking Program is not applicable, cracking is managed by the Water Chemistry Control – BWR Program and either the Inservice Inspection – ISI or One-Time Inspection Program.
3.1.1-42	Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel ID [inside diameter] Attachment Welds and Water Chemistry	No	Consistent with NUREG-1801. The BWR Vessel ID Attachment Welds and Water Chemistry Control – BWR Programs manage cracking in stainless steel vessel attachment welds exposed to reactor coolant.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-43	Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Consistent with NUREG-1801. The BWR Vessel Internals and Water Chemistry Control – BWR Programs manage cracking in stainless steel components of the reactor vessel and vessel internals.
3.1.1-44	Stainless steel and nickel alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Consistent with NUREG-1801 for most components. The BWR Vessel Internals and Water Chemistry Control – BWR Programs manage cracking in stainless steel and nickel-alloy components of the reactor vessel internals exposed to reactor coolant. For the incore flux local power range monitors (LPRM), cracking is managed by the Inservice Inspection – ISI (post refueling pressure test) and Water Chemistry Control – BWR Programs.
3.1.1-45	Steel piping, piping components, and piping elements exposed to reactor coolant	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801. The Flow-Accelerated Corrosion Program manages wall thinning of steel components of the reactor coolant pressure boundary.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-46	Nickel alloy core shroud and core plate access hole cover (mechanical covers)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	The CNS access hole covers are welded, not mechanical (bolted).
3.1.1-47	Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Loss of material in stainless steel and nickel-alloy components of the reactor vessel internals is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control Program to manage loss of material. The Inservice Inspection – ISI Program is not applicable to most reactor vessel internals components since they are not part of the pressure boundary. Management of loss of material using the Water Chemistry Program augmented by the One-Time Inspection Program is consistent with other items of this table, including 3.1.1-14 and 3.1.1-15.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-48	Steel and stainless steel 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 and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	Cracking in stainless steel components of the reactor coolant pressure boundary exposed to reactor coolant is managed by the Inservice Inspection – ISI and Water Chemistry Control – BWR Programs. The One-time Inspection – Small-Bore Piping Program will verify the effectiveness of the water chemistry program and will manage cracking in piping and fitting < 4” NPS. Cracking in steel components is addressed in other line items.
3.1.1-49	Nickel alloy core shroud and core plate access hole cover (welded covers)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and, for BWRs with a crevice in the access hole covers, augmented inspection using UT [ultrasonic testing] or other demonstrated acceptable inspection of the access hole cover welds	No	CNS has welded access hole covers with a crevice behind the weld. Cracking of the nickel-alloy shroud support access hole covers is managed by the BWR Vessel Internals and Water Chemistry Control – BWR Programs. The BWR Vessel Internals Program uses visual and ultrasonic inspections of the access hole covers.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-50	High-strength low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Reactor Head Closure Studs	No	Consistent with NUREG-1801. The Reactor Head Closure Studs Program manages cracking in low alloy steel head closure flange bolting.
3.1.1-51	Cast austenitic stainless steel jet pump assembly castings; orificed fuel support	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Consistent with NUREG-1801. The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program manages the reduction of fracture toughness in cast austenitic stainless steel components of the reactor vessel internals.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-52	Steel and stainless steel reactor coolant pressure boundary (RCPB) pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature systems	Cracking due to stress corrosion cracking, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Cracking of high strength steel bolting is managed by the Bolting Integrity Program. Industry operating experience indicates that loss of material due to wear is not a significant aging effect for this bolting. Occasional thread failures due to wear related mechanisms, such as galling, are event-driven conditions that are resolved as required. Bolting at CNS is standard grade B7 low alloy steel, or similar material, except in rare specialized applications such as where stainless steel bolting is utilized. Loss of preload due to stress relaxation (creep) would only be a concern in very high temperature applications (> 700°F) as stated in the ASME Code, Section II, Part D, Table 4. No CNS bolting operates at > 700°F. Therefore, loss of preload due to stress relaxation (creep) is not an applicable aging effect for the reactor coolant system. Other issues such as gasket creep and self loosening that may result in pressure boundary joint leakage are improper design or maintenance issues. (cont.)

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					(continued from above) Improper bolting application (design) and maintenance issues are current plant operational concerns and not related to aging effects or mechanisms that require management during the period of extended operation. Nevertheless, the Bolting Integrity Program manages loss of preload for all pressure boundary bolting in the reactor coolant system with the exception of the reactor closure head studs. As described in the Bolting Integrity Program, CNS has taken actions to address NUREG–1339, *Resolution to Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*. These actions include implementation of good bolting practices in accordance with Electric Power Research Institute (EPRI) NP-5067, “Good Bolting Practices.” Proper joint preparation and make-up in accordance with industry standards is expected to preclude loss of preload. This has been confirmed by operating experience at CNS.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-53	Steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to general, pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	This item was not used. There are no steel components in the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary exposed to closed cycle cooling water.
3.1.1-54	Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	This item was not used. There are no copper alloy components in the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary.
3.1.1-55	Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250°C (> 482°F)	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection (IWB, IWC, and IWD). Thermal aging susceptibility screening is not necessary, inservice inspection requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	The Inservice Inspection – ISI Program manages the reduction of fracture toughness in cast austenitic stainless steel components in the reactor coolant pressure boundary.

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-56	Copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	This item was not used. There are no copper alloy components in the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary.
3.1.1-57	Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant >250°C (> 482°F)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	The One-Time Inspection Program will confirm the absence of significant degradation (cracking) of the cast austenitic stainless steel main steam flow elements (restrictors). The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program manages the reduction of fracture toughness in the control rod guide tube bases. The flow elements and control rod guide tube bases are not part of the pressure boundary. CNS has no other Class 1 piping, piping components, piping elements, or CRD housings made of CASS. Pump casings and valve bodies and other CASS components are included in item numbers 3.1.1-51 and 3.1.1-55 above.
3.1.1-58	PWR only				
3.1.1-59	PWR only				

Table 3.1.1: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-60	PWR only				
3.1.1-61	PWR only				
3.1.1-62	PWR only				
3.1.1-63	PWR only				
3.1.1-64	PWR only				
3.1.1-65	PWR only				
3.1.1-66	PWR only				
3.1.1-67	PWR only				
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: Reactor Coolant System, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-78	PWR only				
3.1.1-79	PWR only				
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	PWR only				
3.1.1-85	Nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA [not applicable] - No AEM or AMP	Consistent with NUREG-1801.
3.1.1-86	Stainless steel piping, piping components, and piping elements exposed to air – indoor uncontrolled (External); air with borated water leakage; concrete; gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.1.1-87	Steel piping, piping components, and piping elements in concrete	None	None	NA - No AEM or AMP	This item was not used. There are no components in the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary exposed to concrete.

Notes for Tables 3.1.2-1 through 3.1.2-3

Generic Notes

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program 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 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

101. This item is considered a match to NUREG-1801 even though the environments are different because the aging effect of cracking due to fatigue is independent of the environment.

102. High component surface temperature precludes moisture accumulation that could result in corrosion.

103. The One-Time Inspection Program will verify effectiveness of the Water Chemistry Control – BWR Program.

104. The loss of material is a potential aging effect for carbon steel surfaces in air where the surface temperatures are below the local dew point.

105. These components are less than 4 inches NPS and are not part of the reactor coolant pressure boundary. They are not subject to the BWR Stress Corrosion Cracking Program.

106. Cracking of the head seal leak detection line is included in this line item.

107. Cracking of the welded access hole covers is included in this line item.

Table 3.1.2-1
Reactor Vessel
Summary of Aging Management Evaluation

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Reactor vessel components	Pressure boundary, Structural support	Carbon steel, stainless steel, nickel alloy, low-alloy steel clad with stainless steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	IV.A1-7 (R-04)	3.1.1-2	A
Reactor vessel closure bolting • Closure head studs, nuts, washers and bushings • Closure head nozzle flange bolting • CRD flange bolting • Incore monitor housing bolting	Pressure boundary	High-strength low-alloy steel, low alloy steel	Air – indoor (ext)	Cracking – fatigue	TLAA – metal fatigue	IV.A1-7 (R-04)	3.1.1-2	C, 101

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor vessel external attachments • Stabilizer brackets • Support skirt	Structural support	Low-alloy steel, carbon steel	Air – indoor (ext)	Cracking – fatigue	TLAA – metal fatigue	IV.A1-6 (R-70)	3.1.1-1	A
Attachments and Supports								
Reactor vessel external attachments • Stabilizer brackets • Support skirt	Structural support	Low-alloy steel, carbon steel	Air – indoor (ext)	Loss of material	Inservice Inspection – ISI	--	--	H

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor vessel internal attachment welds • Core spray brackets • Dryer support brackets • Feedwater sparger brackets • Guide rod brackets • Jet pump riser support pads • Surveillance specimen holder brackets	Structural support	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Vessel ID Attachment Welds Water Chemistry Control – BWR	IV.A1-12 (R-64)	3.1.1-42	A
Reactor vessel internal attachment welds • Dryer holddown brackets	Structural support	Low-alloy steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-11 (R-59)	3.1.1-11	C, 103

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting								
Incore monitor housing bolting • Capscrews and washers: CRD flange bolting • Capscrews and washers	Pressure boundary	High-strength low-alloy steel	Air – indoor (ext)	Cracking	Bolting Integrity	IV.C2-7 (R-11)	3.1.1-52	C
				Loss of preload	Bolting Integrity	IV.C1-10 (R-27)	3.1.1-52	C
Other bolting • Upper head nozzle flange bolts	Pressure boundary	Low-alloy steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C1-10 (R-27)	3.1.1-52	C
Reactor vessel closure flange bolting • Closure studs, nuts, washers and bushings	Pressure boundary	High-strength low-alloy steel	Air – indoor (ext)	Loss of material	Reactor Head Closure Studs	--	--	H
				Cracking	Reactor Head Closure Studs	IV.A1-9 (R-60)	3.1.1-50	B

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Nozzles and Penetrations								
CRD housings	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-8 (R-104)	3.1.1-43	A
			Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
CRD stub tubes	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.A1-5 (R-69)	3.1.1-40	E
			Air – indoor (ext)	None	None	IV.E-1 (RP-03)	3.1.1-85	A

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Incore monitor housings	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-8 (R-104)	3.1.1-43	C
			Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Nozzles • Core spray (N5A/B) • Jet pump instrument (N8A/B) • Recirc outlet (N1A/B) • Recirc inlet (N2A–K)	Pressure boundary	Low-alloy steel with SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	E
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Nozzles • Core ΔP / SLC (N10) • Instrumentation (N11A/B, N12A/B, N16A/B)	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Penetrations Water Chemistry Control – BWR	IV.A1-5 (R-69)	3.1.1-40	A
			Air – indoor (ext)	None	None	IV.E-1 (RP-03)	3.1.1-85	A
Nozzle • CRD return (N9)	Pressure boundary	Low-alloy steel with SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR CRD Return Line Nozzle Water Chemistry Control – BWR	IV.A1-2 (R-66)	3.1.1-38	A
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle • Drain (N15)	Pressure boundary	Low-alloy steel with partial SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-5 (R-69)	3.1.1-40	E
			Air – indoor (ext)	None	None	--	--	G, 102
Nozzles • Feedwater (N4A–D)	Pressure boundary	Low-alloy steel with partial SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Feedwater Nozzle	IV.A1-3 (R-65)	3.1.1-39	B
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle • High pressure RPV head seal leak detection (N13)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-10 (R-61)	3.1.1-19	E
			Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Nozzle • Main steam (N3A–D)	Pressure boundary	Low-alloy steel with partial SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	E
			Air – indoor (ext)	None	None	--	--	G, 102
Nozzles • Head vent (N7) • Spare (N6A/B)	Pressure boundary	Low-alloy steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-11 (R-59)	3.1.1-11	A, 103
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Safe Ends, Thermal Sleeves, Flanges, Caps								
CRD return line cap (N9)	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Stress Corrosion Cracking Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	B
			Air – indoor (ext)	None	None	IV.E-1 (RP-03)	3.1.1-85	A
Nozzle (head) flanges • Blank flanges (N6A/B) • Nozzle flanges (N6A/B, N7)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-11 (R-59)	3.1.1-11	A, 103
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle safe ends ≥ 4 inch NPS • Core spray (N5A/B) including thermal sleeve • Jet pump instrument (N8A/B) • Recirc inlet (N2A–K) including thermal sleeve • Recirc outlet (N1A/B)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Stress Corrosion Cracking Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	B
			Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Nozzle safe ends ≥ 4 inch NPS • Feedwater (N4A–D) • Main steam (N3A–D)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-11 (R-59)	3.1.1-11	A, 103
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Nozzle safe ends < 4 inch NPS • Core ΔP / SLC (N10) • Instrumentation (N11A/B, N12A/B, N16A/B)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Penetrations Water Chemistry Control – BWR	IV.A1-5 (R-69)	3.1.1-40	A
			Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Nozzle to safe end welds • Core spray (N5A/B) • Jet pump instrument (N8A/B) • Recirc inlet/outlet (N1A/B, N2A–K)	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	BWR Stress Corrosion Cracking Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	B
			Air – indoor (ext)	None	None	IV.E-1 (RP-03)	3.1.1-85	A

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Shell and Heads								
Reactor vessel bottom head	Pressure boundary	Low-alloy steel with SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	E
			Air – indoor (ext)	None	None	--	--	G, 102
Reactor vessel shell • Closure flange	Pressure boundary	Low-alloy steel with SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	E
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor vessel shell • Lower shell and lower intermediate beltline shell and connecting welds	Pressure boundary	Low-alloy steel with SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	E
			Neutron fluence	Reduction of fracture toughness	Reactor Vessel Surveillance TLAA – neutron fluence	IV.A1-14 (R-63) IV.A1-13 (R-62)	3.1.1-18 3.1.1-17	A A
			Air – indoor (ext)	None	None	--	--	G, 102
Reactor vessel shell • Upper intermediate and upper shell	Pressure boundary	Low-alloy steel with SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	E
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Reactor vessel upper head • Closure flange	Pressure boundary	Low-alloy steel with SS clad	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-8 (RP-25)	3.1.1-14	A, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.A1-1 (R-68)	3.1.1-41	E
			Air – indoor (ext)	None	None	--	--	G, 102
Reactor vessel upper head • Top head (dome)	Pressure boundary	Low-alloy steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1-11 (R-59)	3.1.1-11	A, 103
			Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-2
Reactor Vessel Internals
Summary of Aging Management Evaluation

Table 3.1.2-2: Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
RV internals	Structural support, Flow distribution, Floodable volume	Stainless steel, nickel alloy	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	IV.B1-14 (R-53)	3.1.1-5	A
Control rod guide tubes • Tube, thermal sleeve	Structural support	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-8 (R-104)	3.1.1-43	A

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Control rod guide tubes • Base	Structural support	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-8 (R-104)	3.1.1-43	A
			Treated water > 482°F	Reduction of fracture toughness	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.C1-2 (R-52)	3.1.1-57	E
Core spray lines	Flow distribution	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-7 (R-99)	3.1.1-44	A

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core plate assembly	Structural support	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-6 (R-93)	3.1.1-44	A
Core plate assembly • Hold-down bolts	Structural support	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-6 (R-93)	3.1.1-44	A

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fuel support pieces (includes 4-lobe and peripheral)	Structural support	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-6 (R-93)	3.1.1-44	C
			Treated water > 482°F and neutron fluence	Reduction of fracture toughness	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.B1-9 (R-103)	3.1.1-51	A
Fuel support orifices	Flow distribution	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-6 (R-93)	3.1.1-44	C

Table 3.1.2-2: Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Incore flux monitors • Guide tubes	Structural support	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-10 (R-105)	3.1.1-44	A
Incore flux monitors • LPRMs	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.B1-10 (R-105)	3.1.1-44	E
			Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet pump assemblies • Riser pipe, elbow, brace • Hold-down bolt mixer throat (barrel) • Restrainer bracket wedge assemblies • Diffuser shell, tailpipe, adapter (top piece)	Floodable volume	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-13 (R-100)	3.1.1-44	A
Jet pump assemblies • Hold-down beam • Diffuser adapter (bottom piece)	Floodable volume	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-13 (R-100)	3.1.1-44	A

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet pump assemblies • Transition piece • Suction inlet elbow/nozzle • Mixer adapter • Restrainer bracket • Diffuser collar	Floodable volume	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-13 (R-100)	3.1.1-44	A
			Treated water > 482°F Neutron fluence	Reduction of fracture toughness	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.B1-11 (R-101)	3.1.1-51	A
Shroud	Structural support, Floodable volume	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-3 (R-97)	3.1.1-44	A

Table 3.1.2-2: Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Shroud support	Structural support, Floodable volume	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-2 (R-96) IV.B1-5 (R-94)	3.1.1-44 3.1.1-49	A A, 107
Steam dryer	Structural integrity	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-16 (RP-18)	3.1.1-29	E
Top guide assembly	Structural support	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.B1-15 (RP-26)	3.1.1-47	E, 103
				Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1-17 (R-98)	3.1.1-44	A

Table 3.1.2-3
Reactor Coolant Pressure Boundary
Summary of Aging Management Evaluation

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel, stainless steel	Air – indoor (ext)	Cracking – fatigue	TLAA – metal fatigue	IV.C1-15 (R-220) IV.C1-11 (R-28)	3.1.1-3 3.1.1-4	A, 101 A, 101
Reactor coolant pressure boundary components	Pressure boundary	Carbon steel, stainless steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	IV.C1-15 (R-220)	3.1.1-3	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	C
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C
Condensing chambers	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Condensing chambers	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection – ISI One-time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1-1 (R-03)	3.1.1-48	B
Condensing chambers	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Control rod drive	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Control rod drive	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection – ISI Water Chemistry Control – BWR	IV.C1-9 (R-20)	3.1.1-41	E
Control rod drive	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Flow element	Flow control	CASS	Treated water > 140°F (int)	Cracking	One-Time Inspection Water Chemistry Control – BWR	IV.C1-9 (R-20)	3.1.1-41	E

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flow element	Flow control	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Flow element	Flow control	CASS	Treated water > 482°F (int)	Reduction of fracture toughness	One-Time Inspection	IV.C1-2 (R-52)	3.1.1-57	E
Flow element (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Flow element (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E, 105
Flow element (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Instrument line snubber (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Instrument line snubber (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E, 105
Instrument line snubber (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Piping and fittings < 4 inch NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	C, 104

Table 3.1.2-3: Reactor Coolant Pressure Boundary

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and fittings < 4 inch NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Piping and fittings < 4 inch NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1-7 (R-23)	3.1.1-45	B
Piping and fittings < 4 inch NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-6 (R-16)	3.1.1-13	C, 103
Piping and fittings < 4 inch NPS	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Piping and fittings < 4 inch NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection – ISI One-time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1-1 (R-03) IV.A1-10 (R-61)	3.1.1-48 3.1.1-19	B E, 106
Piping and fittings < 4 inch NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Piping and fittings ≥ 4 inch NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	C, 104
Piping and fittings ≥ 4 inch NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102

Table 3.1.2-3: Reactor Coolant Pressure Boundary

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and fittings ≥ 4 inch NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1-7 (R-23)	3.1.1-45	B
Piping and fittings ≥ 4 inch NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-6 (R-16)	3.1.1-13	C, 103
Piping and fittings ≥ 4 inch NPS	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Piping and fittings ≥ 4 inch NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	BWR Stress Corrosion Cracking Inservice Inspection – ISI Water Chemistry Control – BWR	IV.C1-9 (R-20)	3.1.1-41	B
Piping and fittings ≥ 4 inch NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Piping and fittings (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Piping and fittings (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E, 105
Piping and fittings (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	CASS	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Pump casing	Pressure boundary	CASS	Treated water > 140°F (int)	Cracking	BWR Stress Corrosion Cracking Inservice Inspection – ISI Water Chemistry Control – BWR	IV.C1-9 (R-20)	3.1.1-41	B
Pump casing	Pressure boundary	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Pump casing	Pressure boundary	CASS	Treated water > 482°F (int)	Reduction of fracture toughness	Inservice Inspection – ISI	IV.C1-3 (R-08)	3.1.1-55	B
Pump casing-RR driver mount	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	C
Pump cover thermal barrier	Pressure boundary	CASS	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump cover thermal barrier	Pressure boundary	CASS	Treated water > 140°F (int)	Cracking	Inservice Inspection – ISI Water Chemistry Control – Closed Cooling Water	VII.C2-11 (AP-60)	3.3.1-46	D
Pump cover thermal barrier	Pressure boundary	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	D
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection – ISI One-time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1-1 (R-03)	3.1.1-48	B
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Thermal sleeve	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.C1-6 (R-16)	3.1.1-13	C, 103

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermal sleeve	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-6 (R-16)	3.1.1-13	C, 103
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection – ISI One-time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1-1 (R-03)	3.1.1-48	B
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection – ISI One-time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1-1 (R-03)	3.1.1-48	B

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Tubing (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Tubing (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E, 105
Tubing (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Valve body < 4 inch NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	C, 104
Valve body < 4 inch NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Valve body < 4 inch NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1-7 (R-23)	3.1.1-45	B
Valve body < 4 inch NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-6 (R-16)	3.1.1-13	C, 103
Valve body < 4 inch NPS	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body < 4 inch NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection – ISI One-time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1-1 (R-03)	3.1.1-48	B
Valve body < 4 inch NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Valve body (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Valve body (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E, 105
Valve body (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Valve body ≥ 4 inch NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	C, 104
Valve body ≥ 4 inch NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Valve body ≥ 4 inch NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1-7 (R-23)	3.1.1-45	B

Table 3.1.2-3: Reactor Coolant Pressure Boundary

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body ≥ 4 inch NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-6 (R-16)	3.1.1-13	C, 103
Valve body ≥ 4 inch NPS	Pressure boundary	CASS	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
Valve body ≥ 4 inch NPS	Pressure boundary	CASS	Treated water > 140°F (int)	Cracking	BWR Stress Corrosion Cracking Inservice Inspection – ISI Water Chemistry Control – BWR	IV.C1-9 (R-20)	3.1.1-41	B
Valve body ≥ 4 inch NPS	Pressure boundary	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103
Valve body ≥ 4 inch NPS	Pressure boundary	CASS	Treated water > 482°F (int)	Reduction of fracture toughness	Inservice Inspection – ISI	IV.C1-3 (R-08)	3.1.1-55	B
Valve body ≥ 4 inch NPS	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E-2 (RP-04)	3.1.1-86	A

Table 3.1.2-3: Reactor Coolant Pressure Boundary

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body ≥ 4 inch NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	BWR Stress Corrosion Cracking Inservice Inspection – ISI Water Chemistry Control – BWR	IV.C1-9 (R-20)	3.1.1-41	B
Valve body ≥ 4 inch NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	A, 103

3.2 ENGINEERED SAFETY FEATURES

3.2.1 Introduction

This section provides the results of the aging management reviews for components in the ESF systems that are subject to aging management review. The following systems are addressed in this section (system descriptions are available in the referenced sections).

- residual heat removal (Section 2.3.2.1)
- core spray (Section 2.3.2.2)
- automatic depressurization (Section 2.3.2.3)
- high pressure coolant injection (Section 2.3.2.4)
- reactor core isolation cooling (Section 2.3.2.5)[1]
- standby gas treatment (Section 2.3.2.6)
- primary containment system (Section 2.3.2.7)
- miscellaneous ESF systems in scope for 10 CFR 54.4(a)(2) (Section 2.3.2.8)

Table 3.2.1, Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the engineered safety features component groups. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.2.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for systems in the ESF system group.

- Table 3.2.2-1 Residual Heat Removal System—Summary of Aging Management Evaluation
- Table 3.2.2-2 Core Spray System—Summary of Aging Management Evaluation
- Table 3.2.2-3 Automatic Depressurization System—Summary of Aging Management Evaluation
- Table 3.2.2-4 High Pressure Coolant Injection System—Summary of Aging Management Evaluation
- Table 3.2.2-5 Reactor Core Isolation Cooling System—Summary of Aging Management Evaluation

1. Although the RCIC system is not part of the emergency core cooling systems (ECCS) as described in USAR Section VI-3.0, it is included with the ECCS discussion (consistent with NUREG-1801 Chapter V Section D.2) because of its similar functions.

- Table 3.2.2-6 Standby Gas Treatment System—Summary of Aging Management Evaluation
- Table 3.2.2-7 Primary Containment System—Summary of Aging Management Evaluation

Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2)

- Table 3.2.2-8-1 Residual Heat Removal System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-2 Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-3 High Pressure Coolant Injection System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-4 Reactor Core Isolation Cooling, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-5 Standby Gas Treatment System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-6 Primary Containment System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

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 ESF systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.2.2.1.1 <u>Residual Heat Removal</u>

Materials

Residual heat removal system components are constructed of the following materials.

- carbon steel

- copper alloy > 15% zinc or > 8% aluminum
- gray cast iron
- stainless steel

Environment

Residual heat removal system components are exposed to the following environments.

- air – indoor
- raw water
- treated water
- treated water > 140ºF

Aging Effects Requiring Management

The following aging effects associated with the residual heat removal system require management.

- cracking
- cracking – fatigue
- fouling
- loss of material
- loss of material – wear
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on the residual heat removal components.

- Bolting Integrity
- External Surfaces Monitoring
- Selective Leaching
- Service Water Integrity
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Cooling Water

3.2.2.1.2 Core Spray

Materials

Core spray system components are constructed of the following materials.

- carbon steel
- stainless steel

Environment

Core spray system components are exposed to the following environments.

- air – indoor
- treated water

Aging Effects Requiring Management

The following aging effects associated with the core spray system require management.

- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on the core spray system components.

- Bolting Integrity
- External Surfaces Monitoring
- Water Chemistry Control – BWR

3.2.2.1.3 Automatic Depressurization

Materials

Automatic depressurization system components are constructed of the following materials.

- carbon steel
- stainless steel

Environment

Automatic depressurization system components are exposed to the following environments.

- air – indoor
- steam
- treated water

Aging Effects Requiring Management

The following aging effects associated with the automatic depressurization system require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on the automatic depressurization system components.

- Bolting Integrity
- External Surfaces Monitoring
- Periodic Surveillance and Preventive Maintenance
- Water Chemistry Control – BWR

3.2.2.1.4 High Pressure Coolant Injection

Materials

High pressure coolant injection system components are constructed of the following materials.

- carbon steel
- copper alloy
- copper alloy > 15% zinc (inhibited)
- copper alloy > 15% zinc or > 8% aluminum
- glass
- gray cast iron
- nickel alloy
- stainless steel

Environment

High pressure coolant injection system components are exposed to the following environments.

- air – indoor
- concrete
- lube oil
- soil

- steam
- treated water

Aging Effects Requiring Management

The following aging effects associated with the high pressure coolant injection system require management.

- cracking
- cracking – fatigue
- fouling
- loss of material
- loss of material – wear
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on the high pressure coolant injection system components.

- Bolting Integrity
- Buried Piping and Tanks Inspection
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Oil Analysis
- Periodic Surveillance and Preventive Maintenance
- Water Chemistry Control – BWR

3.2.2.1.5 Reactor Core Isolation Cooling

Materials

Reactor core isolation cooling system components are constructed of the following materials.

- carbon steel
- copper alloy > 15% zinc (inhibited)
- copper alloy > 15% zinc or > 8% aluminum
- glass
- gray cast iron
- nickel alloy
- stainless steel

Environment

Reactor core isolation cooling system components are exposed to the following environments.

- air – indoor
- condensation
- lube oil
- steam
- treated water

Aging Effects Requiring Management

The following aging effects associated with the reactor core isolation cooling system require management.

- cracking
- cracking – fatigue
- fouling
- loss of material
- loss of material – wear
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on the reactor core isolation cooling system components.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Oil Analysis
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – BWR

3.2.2.1.6 Standby Gas Treatment

Materials

Standby gas treatment system components are constructed of the following materials.

- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- elastomer

- nickel alloy
- stainless steel

Environment

Standby gas treatment system components are exposed to the following environments.

- air – indoor
- air – outdoor
- raw water
- soil

Aging Effects Requiring Management

The following aging effects associated with the standby gas treatment system require management.

- change in material properties
- cracking
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on the standby gas treatment system components.

- Bolting Integrity
- Buried Piping and Tanks Inspection
- External Surfaces Monitoring
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance

3.2.2.1.7 Primary Containment System

Materials

Primary containment system components are constructed of the following materials.

- carbon steel
- copper alloy
- glass
- stainless steel

Environment

Primary containment system components are exposed to the following environments.

- air – indoor
- air – treated
- gas
- raw water
- treated water

Aging Effects Requiring Management

The following aging effects associated with the primary containment system require management.

- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on the primary containment system components.

- Bolting Integrity
- External Surfaces Monitoring
- Periodic Surveillance and Preventive Maintenance
- Water Chemistry Control – BWR

3.2.2.1.8 Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2)

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.2.2-8-xx tables.

Materials

Nonsafety-related components affecting safety-related systems are constructed of the following materials.

- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- glass
- gray cast iron
- stainless steel

Environment

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- air – indoor
- air – treated
- gas
- steam
- treated water
- treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Selective Leaching
- Water Chemistry Control – BWR

3.2.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 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 CNS approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.2.2.2.1 Cumulative Fatigue Damage

Where identified as an aging effect requiring management, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). Evaluation of this TLAA is addressed in Section 4.3.

3.2.2.2.2 Loss of Material due to Cladding [Breach]

This item covers loss of material due to cladding breach on PWR steel pump casings. CNS is a BWR and does not have charging pumps or steel pump casings with stainless steel cladding. This item was not used.

3.2.2.2.3 Loss of Material due to Pitting and Crevice Corrosion

1. Loss of material due to pitting and crevice corrosion for internal surfaces of stainless steel piping and components in containment isolation components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

2. Loss of material from pitting and crevice corrosion for stainless steel piping and piping components exposed to a soil environment is managed by the Buried Piping and Tanks Inspection Program. The Buried Piping and Tanks Inspection Program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, gray cast iron and stainless steel components. Buried components will be inspected when excavated during maintenance. An inspection will be performed within ten years of entering the period of extended operation, unless an opportunistic inspection occurred within this ten-year period.

3. Loss of material from pitting and crevice corrosion for BWR stainless steel piping and piping components exposed to treated water is managed by the Water Chemistry Control – BWR Program. There are no aluminum components exposed to treated water in the ESF systems. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

4. Loss of material from pitting and crevice corrosion could occur for copper alloy and stainless steel piping and components in ESF systems that are exposed to lubricating oil. Loss of material is managed by the Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

5. Loss of material from pitting and crevice corrosion could occur for partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. At CNS there are no outdoor stainless steel tanks in the ESF systems. This item was not used.

6. Loss of material from pitting and crevice corrosion for ESF stainless steel components internally exposed to condensation at CNS is managed by the Periodic Surveillance and Preventive Maintenance Program. This program will periodically visually inspect a representative sample of component internal surfaces to assure no unacceptable loss of material is occurring.

3.2.2.2.4 Reduction of Heat Transfer due to Fouling

1. Reduction of heat transfer due to fouling for copper alloy heat exchanger tubes exposed to lubricating oil in ESF systems is managed by the Oil Analysis Program. There are no stainless steel or steel heat exchanger tubes exposed to lubricating oil in the ESF systems. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to fouling. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

2. Reduction of heat transfer due to fouling for stainless steel heat exchanger tubes exposed to treated water in ESF systems is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

3.2.2.2.5 Hardening and Loss of Strength due to Elastomer Degradation

Cracking and change in material properties due to elastomer degradation could occur in elastomer components exposed to indoor air. These aging effects are managed by the Periodic Surveillance and Preventive Maintenance Program. This program includes periodic visual inspections and physical manipulation of the flexible connections to confirm that the components are not experiencing any aging that would affect accomplishing their intended functions.

3.2.2.2.6 Loss of Material due to Erosion

This discussion refers to stainless steel high pressure safety injection (HPSI) pump miniflow recirculation orifice exposed to treated borated water. CNS is a BWR and has no HPSI pump miniflow orifice. This item was not used.

3.2.2.2.7 Loss of Material due to General Corrosion and Fouling

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. At CNS the spray nozzles are copper alloy and are not subject to loss of material due to general corrosion in an indoor air environment. There are also no steel orifices in drywell and suppression chamber spray systems internally exposed to an indoor air environment.

3.2.2.2.8 Loss of Material due to General, Pitting, and Crevice Corrosion

1. Loss of material due to general, pitting and crevice corrosion for BWR steel piping and components in ESF systems exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow. The Periodic Surveillance and Preventive Maintenance Program supplements the Water Chemistry Control – BWR Program for components at the waterline in the suppression chamber using periodic visual inspections or other non-destructive examinations (NDE) techniques.

2. Loss of material due to general, pitting and crevice corrosion for primary containment penetration steel piping and components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

3. Loss of material due to general, pitting and crevice corrosion for steel and cast iron piping and components in ESF systems exposed to lubricating oil is managed by the Oil Analysis Program. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program

has been effective at managing aging effects for components crediting this program.

3.2.2.2.9 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)

Loss of material due to general, pitting, crevice, and MIC for steel (with or without coating or wrapping) piping buried in soil in ESF systems at CNS is managed by the Buried Piping and Tanks Inspection Program. The Buried Piping and Tanks Inspection Program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel components. Buried components will be inspected when excavated during maintenance. An inspection will be performed within ten years of entering the period of extended operation, unless an opportunistic inspection occurred within this ten-year period.

3.2.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of CNS quality assurance procedures and administrative controls for aging management programs.

3.2.2.3 Time-Limited Aging Analyses

The only time-limited aging analysis identified for the ESF systems components is metal fatigue. This is evaluated in Section 4.3.

3.2.3 Conclusion

The ESF system 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 the effects of aging on ESF components are identified in Section 3.2.2.1 and in the following tables. 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 demonstrations provided in Appendix B, the effects of aging associated with the ESF components 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 3.2.1
Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-1	Steel and stainless steel piping, piping components, and piping elements in emergency core cooling system	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA. See Section 3.2.2.2.1
3.2.1-2	PWR only				
3.2.1-3	Stainless steel containment isolation piping and components internal surfaces exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in stainless steel components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. See Section 3.2.2.2.3 item 1.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-4	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The Buried Piping and Tanks Inspection Program manages loss of material in stainless steel components exposed to soil. See Section 3.2.2.2.3 item 2.
3.2.1-5	Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in stainless steel components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. There are no aluminum components exposed to treated water in the ESF systems. See Section 3.2.2.2.3 item 3.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-6	Stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages loss of material in stainless steel and copper alloy components. The One-Time Inspection Program will be used to verify the effectiveness of the Oil Analysis program. See Section 3.2.2.2.3 item 4.
3.2.1-7	Partially encased stainless steel tanks with breached moisture barrier exposed to raw water	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes, plant specific	This item was not used. There are no outdoor stainless steel tanks in the ESF systems. See Section 3.2.2.2.3 item 5.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-8	Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The Periodic Surveillance and Preventive Maintenance Program will manage loss of material for internal stainless steel surfaces exposed to condensation in ESF systems. The Periodic Surveillance and Preventive Maintenance Program will periodically visually inspect a representative sample of component internal surfaces. See Section 3.2.2.2.3 item 6.
3.2.1-9	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages reduction of heat transfer in copper alloy heat exchanger tubes. The One-Time InspectionProgram will be used to verify the effectiveness of the Oil Analysis program. There are no stainless steel or steel heat exchanger tubes exposed to lube oil in the ESF systems. See Section 3.2.2.2.4 item 1.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-10	Stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The reduction of heat transfer in stainless steel heat exchanger tubes is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. See Section 3.2.2.2.4 item 2.
3.2.1-11	Elastomer seals and components in standby gas treatment system exposed to air - indoor uncontrolled	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The change in material properties of elastomer components will be managed by the Periodic Surveillance and Preventive Maintenance Program. See Section 3.2.2.2.5.
3.2.1-12	PWR only				

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-13	Steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled (internal)	Loss of material due to general corrosion and fouling	A plant-specific aging management program is to be evaluated.	Yes, plant specific	This item was not used. There are no steel nozzles or flow orifices internally exposed to air in the drywell and suppression chamber spray flow paths. See Section 3.2.2.2.7.
3.2.1-14	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in steel components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The Periodic Surveillance and Preventive Maintenance Program supplements water chemistry for components at the waterline in the suppression pool. See Section 3.2.2.2.8 item 1.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-15	Steel containment isolation piping, piping components, and piping elements internal surfaces exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in steel components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. See Section 3.2.2.2.8 item 2.
3.2.1-16	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages loss of material in steel components exposed to lubricating oil. The One-Time Inspection Program will be used to verify the effectiveness of the Oil Analysis program. See Section 3.2.2.2.8 item 3.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-17	Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	Consistent with NUREG-1801. The loss of material of buried steel piping will be managed by the Buried Piping and Tanks Inspection Program. See Section 3.2.2.2.9.
3.2.1-18	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	The Water Chemistry Control – BWR Program manages cracking of stainless steel components. None of the ESF system components are within the scope of the BWR Stress Corrosion Cracking Program (all relevant components are included in the reactor vessel, internals and reactor coolant pressure boundary systems). The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to verify the effectiveness of the water chemistry program.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-19	Steel piping, piping components, and piping elements exposed to steam or treated water	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801. The Flow-Accelerated Corrosion Program manages wall thinning in steel piping.
3.2.1-20	Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated water (borated or unborated) >250°C (>482°F)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	This item was not used. There are no CASS components in the ESF systems.
3.2.1-21	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	This item was not used. High strength steel closure bolting is not used in ESF systems.
3.2.1-22	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Bolting Integrity	No	This item was not used. All steel closure bolting exposed to air (external) is conservatively assumed to be exposed to indoor uncontrolled air (see Item Number 3.2.1-23).

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-23	Steel bolting and closure bolting exposed to air – outdoor (external), or air – indoor uncontrolled (external)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Consistent with NUREG-1801. The Bolting Integrity Program manages loss of material for steel bolting.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-24	Steel closure bolting exposed to air – indoor uncontrolled (external)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Loss of preload is a design-driven effect and not an aging effect requiring management. Bolting at CNS is standard grade B7 low alloy steel, or similar material, except in rare specialized applications such as where stainless steel bolting is utilized. Loss of preload due to stress relaxation (creep) would only be a concern in very high temperature applications (> 700°F) as stated in the ASME Code, Section II, Part D, Table 4. No CNS bolting operates at > 700°F. Therefore, loss of preload due to stress relaxation (creep) is not an applicable aging effect for ESF systems. Other issues that may result in pressure boundary joint leakage such as gasket creep and self-loosening are improper design or maintenance issues. Improper bolting application (design) and maintenance issues are current plant operational concerns and not related to aging effects or mechanisms that require management during the period of extended operation. (continued below)

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Nevertheless, the Bolting Integrity Program manages loss of preload for all bolting in the ESF systems. As described in the Bolting Integrity Program, CNS has taken actions to address NUREG–1339, *Resolution to Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*. These actions include implementation of good bolting practices in accordance with EPRI NP-5067, "Good Bolting Practices." Proper joint preparation and make-up in accordance with industry standards is expected to preclude loss of preload. This has been confirmed by operating experience at CNS.
3.2.1-25	Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	This item was not used. There are no stainless steel components exposed to closed cycle cooling water > 60°C (> 140°F) in the ESF systems.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-26	Steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	This item was not used. Steel containment isolation components exposed to closed cycle cooling water are part of other systems that are evaluated separately.
3.2.1-27	Steel heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Water Chemistry Control – Closed Cooling Water Program manages loss of material for steel components. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program.
3.2.1-28	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Water Chemistry Control – Closed Cooling Water Program manages loss of material for stainless steel components. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-29	Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	This item was not used. There are no copper alloy components exposed to closed cycle cooling water in the ESF systems.
3.2.1-30	Stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	This item was not used. There are no stainless steel or copper alloy heat exchanger tubes exposed to closed cycle cooling water with heat transfer as an intended function in the ESF systems.
3.2.1-31	External surfaces of steel components including ducting, piping, ducting closure bolting, and containment isolation piping external surfaces exposed to air - indoor uncontrolled (external); condensation (external) and air - outdoor (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring Program manages loss of material for external surfaces of steel components.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-32	Steel piping and ducting components and internal surfaces exposed to air – indoor uncontrolled (Internal)	Loss of material due to general corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	The loss of material from the internal surfaces of steel components exposed to air – indoor is managed by the External Surfaces Monitoring, Fire Protection and Periodic Surveillance and Preventive Maintenance Programs. The External Surfaces Monitoring Program manages loss of material for external carbon steel components by visual inspection of external surfaces. For systems where internal carbon steel surfaces are exposed to the same environment as external surfaces, external surface conditions will be representative of internal surfaces. Thus, loss of material on internal carbon steel surfaces is also managed by the External Surfaces Monitoring Program. The Fire Protection and Periodic Surveillance and Preventive Maintenance Programs manage loss of material of carbon steel components by periodic visual inspection of component internal surfaces.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-33	Steel encapsulation components exposed to air-indoor uncontrolled (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	This item was not used. The ESF systems have no steel encapsulation components.
3.2.1-34	Steel piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	The Periodic Surveillance and Preventive Maintenance Program will manage loss of material for steel components exposed to internal condensation. The Periodic Surveillance and Preventive Maintenance Program will periodically visually inspect a representative sample of component internal surfaces.
3.2.1-35	Steel containment isolation piping and components internal surfaces exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	The Periodic Surveillance and Preventive Maintenance Program manages loss of material for steel components exposed to un-monitored water (drain or sump water evaluated as raw water). The Periodic Surveillance and Preventive Maintenance Program will periodically visually inspect a representative sample of component internal surfaces.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-36	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Service Water Integrity Program manages loss of material for carbon steel components exposed to raw water.
3.2.1-37	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	The One-Time Inspection Program will confirm the absence of significant loss of material for stainless steel components exposed to un-monitored water (drain or sump water evaluated as raw water). Visual or other NDE techniques will be used to inspect a representative sample of the internal surfaces to confirm the absence of significant loss of material.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-38	Stainless steel containment isolation piping and components internal surfaces exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	This item was not used. For those systems that were included in the scope of license renewal for support of containment isolation, but were not reviewed as a separate system, there are no stainless steel components exposed to open cycle cooling water. Stainless steel components of other system exposed to open cycle cooling water were compared to other line items.
3.2.1-39	Stainless steel heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Service Water Integrity Program manages loss of material for stainless steel heat exchanger components exposed to raw water.
3.2.1-40	Steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Service Water Integrity Program manages reduction of heat transfer for stainless steel heat exchanger tubes exposed to raw water. There are no steel heat exchanger tubes exposed to raw water in the ESF systems.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-41	Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	This item was not used. There are no copper alloy > 15% zinc components exposed to closed cycle cooling water in the ESF systems.
3.2.1-42	Gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. The Selective Leaching Program will manage loss of material due to selective leaching for gray cast iron components exposed to closed cycle cooling water.
3.2.1-43	Gray cast iron piping, piping components, and piping elements exposed to soil	Loss of material due to selective leaching	Selective Leaching of Materials	No	This item was not used. There are no gray cast iron components exposed to soil in the ESF systems.
3.2.1-44	Gray cast iron motor cooler exposed to treated water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. The Selective Leaching Program will manage loss of material due to selective leaching for gray cast iron components exposed to treated water.
3.2.1-45	PWR only				

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-46	PWR only				
3.2.1-47	PWR only				
3.2.1-48	PWR only				
3.2.1-49	PWR only				
3.2.1-50	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 for components in the auxiliary and steam and power conversion systems. There are no aluminum components exposed to indoor air in the ESF systems.
3.2.1-51	Galvanized steel ducting exposed to air – indoor controlled (external)	None	None	NA - No AEM or AMP	This item was not used. Galvanized steel surfaces are evaluated as steel for the ESF systems.
3.2.1-52	Glass piping elements exposed to air – indoor uncontrolled (external), lubricating oil, raw water, treated water, or treated borated water	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-53	Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.2.1-54	Steel piping, piping components, and piping elements exposed to air – indoor controlled (external)	None	None	NA - No AEM or AMP	This item was not used. There are no steel components of the ESF systems in indoor controlled air environments. All indoor air environments are conservatively considered to be uncontrolled.
3.2.1-55	Steel and stainless steel piping, piping components, and piping elements in concrete	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for steel components exposed to concrete. There are no stainless steel components in ESF systems exposed to concrete.
3.2.1-56	Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.2.1-57	PWR only				

Notes for Tables 3.2.2-1 through 3.2.2-8-6

Generic Notes

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program 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 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

201. The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program.

202. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

203. This treated water environment is the equivalent of the NUREG-1801 defined closed cycle cooling water.

204. This treated water environment is controlled by the Water Chemistry Control – Auxiliary Systems Program. Although this environment does not directly compare with any NUREG-1801 defined environment, it approximates the NUREG-1801 defined closed cycle cooling water environment.

205. The Periodic Surveillance and Preventive Maintenance Program applies to the piping and T-quenchers at the suppression pool waterline.

206. Since loss of preload is not significantly dependent on environment, the environment given in this line is considered equivalent to the NUREG-1801 defined environments of air with reactor coolant leakage or air indoor uncontrolled for the evaluation of this aging effect.

Table 3.2.2-1
Residual Heat Removal System
Summary of Aging Management Evaluation

Table 3.2.2-1: Residual Heat Removal System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-1: Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flange	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Flange	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	V.D2-8 (E-18)	3.2.1-36	A
Heat exchanger (bonnet)	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Heat exchanger (bonnet)	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	V.D1-20 (EP-52)	3.2.1-42	C, 203

Table 3.2.2-1: Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (bonnet)	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	V.D2-7 (E-17)	3.2.1-27	B
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	C, 201
Heat exchanger (shell)	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Heat exchanger (shell)	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	V.A-18 (E-43)	3.2.1-44	C
Heat exchanger (shell)	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	C, 201
Heat exchanger (tubes)	Heat transfer	Stainless steel	Raw water (int)	Fouling	Service Water Integrity	V.D2-12 (E-21)	3.2.1-40	A
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water > 140°F (ext)	Fouling	Water Chemistry Control – BWR	V.D2-13 (EP-34)	3.2.1-10	A, 201

Table 3.2.2-1: Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	V.D2-6 (E-20)	3.2.1-39	A
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	V.D2-5 (E-19)	3.2.1-28	B
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Loss of material-wear	Service Water Integrity	--	--	H
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Instrument snubber	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Instrument snubber	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Instrument snubber	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-1: Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle	Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Nozzle	Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	--	--	G
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E

Table 3.2.2-1: Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Strainer	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-1: Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Thermowell	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Thermowell	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Trap	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.2.2-1: Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-2
Core Spray System
Summary of Aging Management Evaluation

Table 3.2.2-2: Core Spray System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Flange	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Flange	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-2: Core Spray System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Flow element	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Instrument snubber	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-2: Core Spray System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Strainer	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Strainer	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-2: Core Spray System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-3
Automatic Depressurization System
Summary of Aging Management Evaluation

Table 3.2.2-3: Automatic Depressurization System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2-33 (E-08)	3.2.1-14	E, 205

Table 3.2.2-3: Automatic Depressurization System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2-33 (E-08)	3.2.1-14	E, 205
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
T-quencher	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2-33 (E-08)	3.2.1-14	E, 205
T-quencher	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
T-quencher	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2-33 (E-08)	3.2.1-14	E, 205
T-quencher	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
T-quencher	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
T-quencher	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-3: Automatic Depressurization System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201

Table 3.2.2-3: Automatic Depressurization System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-4
High Pressure Coolant Injection System
Summary of Aging Management Evaluation

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	C, 201
Bolting	Pressure boundary	Carbon steel	Treated water (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A, 206
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Flex hose	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Flex hose	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Flex hose	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	V.D1-24 (EP-51)	3.2.1-6	C, 202
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	C, 201
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	C, 202
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Fouling	Oil Analysis	V.D2-9 (EP-47)	3.2.1-9	A, 202
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Fouling	Water Chemistry Control – BWR	VIII.E-10 (SP-58)	3.4.1-9	C, 201
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	A, 202
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material-wear	Periodic Surveillance and Preventive Maintenance	--	--	H
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-7 (AP-64)	3.3.1-31	C, 201
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Instrument snubber	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	V.B-9 (E-42)	3.2.1-17	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-31 (E-07)	3.2.1-19	B
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Pump casing	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Reduction gear housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Reduction gear housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Restriction orifice	Flow control	Nickel alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	C, 201
Restriction orifice	Flow control	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	C, 201

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice	Flow control	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Restriction orifice	Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Restriction orifice	Pressure boundary Flow control	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Restriction orifice	Pressure boundary Flow control	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Restriction orifice	Pressure boundary Flow control	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Restriction orifice body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Restriction orifice body	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	V.F-11 (EP-17)	3.2.1-53	A
Restriction orifice body	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	C, 201
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	A, 202
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F-6 (EP-15)	3.2.1-52	A

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	V.F-7 (EP-16)	3.2.1-52	A
Strainer	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Strainer	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Tank	Pressure boundary	Carbon steel	Concrete (ext)	None	None	V.F-17 (EP-5)	3.2.1-55	A
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Thermowell	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Trap	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Trap	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Tubing	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	A, 202
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-7 (AP-64)	3.3.1-31	C, 201
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	V.D1-24 (EP-51)	3.2.1-6	C, 202
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Turbine casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Turbine casing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-31 (E-07)	3.2.1-19	B

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Valve body	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	A, 202
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	A, 202
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	V.D1-24 (EP-51)	3.2.1-6	C, 202
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-5
Reactor Core Isolation Cooling System
Summary of Aging Management Evaluation

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	C, 201
Bolting	Pressure boundary	Carbon steel	Treated water (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A, 206
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Cyclone - separator	Pressure boundary Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Filter	Filtration	Carbon steel	Lube oil (ext)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Filter housing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Filter housing	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Heat exchanger (bonnet)	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Heat exchanger (bonnet)	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	V.A-18 (E-43)	3.2.1-44	C
Heat exchanger (bonnet)	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	C, 201

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Heat exchanger (shell)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	C, 202
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	C, 202
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (ext)	Loss of material	Selective Leaching	VII.E1-3 (AP-65)	3.3.1-84	C
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	VII.A4-7 (AP-64)	3.3.1-31	C, 201
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Fouling	Oil Analysis	V.D2-9 (EP-47)	3.2.1-9	A, 202
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Fouling	Water Chemistry Control – BWR	VIII.E-10 (SP-58)	3.4.1-9	C, 201
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	A, 202

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material-wear	Periodic Surveillance and Preventive Maintenance	--	--	H
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-7 (AP-64)	3.3.1-31	C, 201
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Instrument snubber	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2-17 (E-27)	3.2.1-34	E
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-31 (E-07)	3.2.1-19	B

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Piping	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Piping	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	V.D1-24 (EP-51)	3.2.1-6	C, 202
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Pump casing	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice	Flow control	Nickel alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	C, 201
Restriction orifice	Flow control	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	C, 201
Restriction orifice	Flow control	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Restriction orifice	Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Restriction orifice	Pressure boundary Flow control	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	V.D1-24 (EP-51)	3.2.1-6	C, 202
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Restriction orifice body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Restriction orifice body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Restriction orifice body	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	V.F-11 (EP-17)	3.2.1-53	A
Restriction orifice body	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1-14 (RP-27)	3.1.1-15	C, 201
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F-6 (EP-15)	3.2.1-52	A
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	V.F-7 (EP-16)	3.2.1-52	A
Strainer	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Strainer	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Thermowell	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Trap	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Trap	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Tubing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Tubing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	V.D1-24 (EP-51)	3.2.1-6	C, 202
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Turbine casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Turbine casing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2-17 (E-27)	3.2.1-34	E
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2-30 (EP-46)	3.2.1-16	A, 202
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-31 (E-07)	3.2.1-19	B
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	V.D2-22 (EP-45)	3.2.1-6	A, 202
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Cracking	Periodic Surveillance and Preventive Maintenance	--	--	H
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2-35 (E-14)	3.2.1-8	E
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	V.D1-24 (EP-51)	3.2.1-6	C, 202
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-6
Standby Gas Treatment System
Summary of Aging Management Evaluation

Table 3.2.2-6: Standby Gas Treatment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	V.E-1 (EP-1)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A, 206
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Damper housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Damper housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Damper housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Damper housing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G

Table 3.2.2-6: Standby Gas Treatment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Duct	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Duct	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Fan housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Filter housing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Filter unit housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Filter unit housing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.C-5 (E-22)	3.2.1-35	E
Flexible connection	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	Periodic Surveillance and Preventive Maintenance	V.B-4 (E-06)	3.2.1-11	E

Table 3.2.2-6: Standby Gas Treatment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flexible connection	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	Periodic Surveillance and Preventive Maintenance	V.B-4 (E-06)	3.2.1-11	E
Flexible connection	Pressure boundary	Elastomer	Air – indoor (int)	Change in material properties	Periodic Surveillance and Preventive Maintenance	V.B-4 (E-06)	3.2.1-11	E
Flexible connection	Pressure boundary	Elastomer	Air – indoor (int)	Cracking	Periodic Surveillance and Preventive Maintenance	V.B-4 (E-06)	3.2.1-11	E
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Flow element	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Moisture separator housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Moisture separator housing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	V.D1-25 (EP-55)	3.2.1-37	E
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E

Table 3.2.2-6: Standby Gas Treatment System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	V.E-8 (E-45)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Air – outdoor (int)	Loss of material	External Surfaces Monitoring	VIII.B1-6 (SP-59)	3.4.1-30	E
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.C-5 (E-22)	3.2.1-35	E
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	V.B-9 (E-42)	3.2.1-17	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (int)	None	None	--	--	G
Restriction orifice	Pressure boundary Flow control	Stainless steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	V.D2-27 (EP-31)	3.2.1-4	E

Table 3.2.2-6: Standby Gas Treatment System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Rupture disk	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	V.F-11 (EP-17)	3.2.1-53	A
Rupture disk	Pressure boundary	Nickel alloy	Air – indoor (int)	None	None	--	--	G
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Trap	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.C-5 (E-22)	3.2.1-35	E
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G

Table 3.2.2-6: Standby Gas Treatment System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.C-5 (E-22)	3.2.1-35	E
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Valve body	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-9 (A-44)	3.3.1-81	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G

Table 3.2.2-6: Standby Gas Treatment System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	V.D1-25 (EP-55)	3.2.1-37	E

Table 3.2.2-7
Primary Containment System
Summary of Aging Management Evaluation

Table 3.2.2-7: Primary Containment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Flange	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Flange	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.C-5 (E-22)	3.2.1-35	E
Flange	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-6 (E-31)	3.2.1-15	A, 201
Flex hose	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Flex hose	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G

Table 3.2.2-7: Primary Containment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flexible connection	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Flexible connection	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-6 (E-31)	3.2.1-15	A, 201
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F-6 (EP-15)	3.2.1-52	A
Flow indicator	Pressure boundary	Glass	Gas (int)	None	None	--	--	G
Flow indicator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Flow indicator	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F-15 (EP-22)	3.2.1-56	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.C-5 (E-22)	3.2.1-35	E
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-6 (E-31)	3.2.1-15	A, 201

Table 3.2.2-7: Primary Containment System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Piping	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	C
Piping	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F-15 (EP-22)	3.2.1-56	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-4 (E-33)	3.2.1-3	A, 201
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Pump casing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Restriction orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A

Table 3.2.2-7: Primary Containment System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Copper alloy	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	C
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	C
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F-15 (EP-22)	3.2.1-56	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-4 (E-33)	3.2.1-3	A, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-7: Primary Containment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	C
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.C-5 (E-22)	3.2.1-35	E
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-6 (E-31)	3.2.1-15	A, 201
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	C
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F-15 (EP-22)	3.2.1-56	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-4 (E-33)	3.2.1-3	A, 201

Table 3.2.2-8-1
Residual Heat Removal System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.2.2-8-1: Residual Heat Removal System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A

Table 3.2.2-8-1: Residual Heat Removal System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C

Table 3.2.2-8-1: Residual Heat Removal System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E

Table 3.2.2-8-2
Core Spray System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.2.2-8-2: Core Spray System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-8-2: Core Spray System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201

Table 3.2.2-8-3
High Pressure Coolant Injection System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.2.2-8-3: High Pressure Coolant Injection System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	C, 201
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-8-3: High Pressure Coolant Injection System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-31 (E-07)	3.2.1-19	B
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-34 (E-09)	3.2.1-19	B
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Restriction orifice	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201

Table 3.2.2-8-3: High Pressure Coolant Injection System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Restriction orifice	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Restriction orifice	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Rupture disk	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Rupture disk	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Rupture disk	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Rupture disk	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201

Table 3.2.2-8-3: High Pressure Coolant Injection System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-8-3: High Pressure Coolant Injection System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-31 (E-07)	3.2.1-19	B
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-34 (E-09)	3.2.1-19	B
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-7 (AP-64)	3.3.1-31	C, 201
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C

Table 3.2.2-8-3: High Pressure Coolant Injection System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E

Table 3.2.2-8-4
Reactor Core Isolation Cooling System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.2.2-8-4: Reactor Core Isolation Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Flow indicator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Flow indicator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F-6 (EP-15)	3.2.1-52	A
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	V.F-10 (EP-29)	3.2.1-52	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-8-4: Reactor Core Isolation Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-31 (E-07)	3.2.1-19	B
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-34 (E-09)	3.2.1-19	B
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Restriction orifice	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201

Table 3.2.2-8-4: Reactor Core Isolation Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Rupture disk	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Rupture disk	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Rupture disk	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Rupture disk	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F-6 (EP-15)	3.2.1-52	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	V.F-10 (EP-29)	3.2.1-52	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	C, 201
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A

Table 3.2.2-8-4: Reactor Core Isolation Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-31 (E-07)	3.2.1-19	B

Table 3.2.2-8-4: Reactor Core Isolation Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2-34 (E-09)	3.2.1-19	B
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 201
Valve body	Pressure boundary	Gray cast iron	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Selective Leaching	--	--	G
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2-32 (E-10)	3.2.1-1	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	V.A-18 (E-43)	3.2.1-44	C

Table 3.2.2-8-4: Reactor Core Isolation Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2-28 (EP-32)	3.2.1-5	A, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	V.D2-29 (E-37)	3.2.1-18	E
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.2.2-8-5
Standby Gas Treatment System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.2.2-8-5: Standby Gas Treatment System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	C

Table 3.2.2-8-6
Primary Containment System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.2.2-8-6: Primary Containment System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E-4 (EP-25)	3.2.1-23	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E-5 (EP-24)	3.2.1-24	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 206
Damper housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Damper housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Flow element	Pressure boundary	Carbon steel	Gas (int)	None	None	V.F-18 (EP-7)	3.2.1-56	A
Flow indicator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A

Table 3.2.2-8-6: **Primary Containment System** [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flow indicator	Pressure boundary	Carbon steel	Gas (int)	None	None	V.F-18 (EP-7)	3.2.1-56	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-6 (E-31)	3.2.1-15	A, 201
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	V.F-18 (EP-7)	3.2.1-56	A
Pump casing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Pump casing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-7 (AP-64)	3.3.1-31	C, 201
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Restriction orifice	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-6 (E-31)	3.2.1-15	A, 201
Rupture disk	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Rupture disk	Pressure boundary	Carbon steel	Gas (int)	None	None	V.F-18 (EP-7)	3.2.1-56	A

Table 3.2.2-8-6: Primary Containment System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-4 (E-33)	3.2.1-3	A, 201
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F-15 (EP-22)	3.2.1-56	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-6 (E-31)	3.2.1-15	A, 201
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	V.F-18 (EP-7)	3.2.1-56	A
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A
Valve body	Pressure boundary	Copper alloy	Gas (int)	None	None	V.F-4 (EP-9)	3.2.1-56	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	A

Table 3.2.2-8-6: Primary Containment System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-7 (AP-64)	3.3.1-31	C, 201
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.A4-9 (AP-32)	3.3.1-84	C
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E-7 (E-44)	3.2.1-31	A
Valve body	Pressure boundary	Gray cast iron	Gas (int)	None	None	V.F-18 (EP-7)	3.2.1-56	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2-33 (E-08)	3.2.1-14	A, 201
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	V.A-18 (E-43)	3.2.1-44	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F-12 (EP-18)	3.2.1-53	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C-4 (E-33)	3.2.1-3	A, 201
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F-15 (EP-22)	3.2.1-56	A

3.3 AUXILIARY SYSTEMS

3.3.1 Introduction

This section provides the results of the aging management reviews for those components in the auxiliary systems which are subject to aging management review. The following systems are addressed in this section (system descriptions are available in the referenced sections).

- standby liquid control (Section 2.3.3.1)
- control rod drive (Section 2.3.3.2)
- service water (Section 2.3.3.3)
- diesel generator (Section 2.3.3.4)
- fuel oil (Section 2.3.3.5)
- fire protection – water (Section 2.3.3.6)
- Halon and CO_2 (Section 2.3.3.7)
- heating, ventilation and air conditioning (Section 2.3.3.8)
- fuel pool cooling and cleanup (Section 2.3.3.9)
- instrument air (Section 2.3.3.10)
- reactor equipment cooling (Section 2.3.3.11)
- plant drains (Section 2.3.3.12)
- nitrogen (Section 2.3.3.13)
- miscellaneous auxiliary systems in scope for 10 CFR 54.4(a)(2) (Section 2.3.3.14)

Table 3.1.1, 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 auxiliary systems.

- Table 3.3.2-1 Standby Liquid Control System—Summary of Aging Management Evaluation
- Table 3.3.2-2 Control Rod Drive System—Summary of Aging Management Evaluation
- Table 3.3.2-3 Service Water Systems—Summary of Aging Management Evaluation
- Table 3.3.2-4 Diesel Generator System—Summary of Aging Management Evaluation
- Table 3.3.2-5 Fuel Oil Systems—Summary of Aging Management Evaluation

- Table 3.3.2-6 Fire Protection Water System—Summary of Aging Management Evaluation
- Table 3.3.2-7 Halon and CO_2 Systems—Summary of Aging Management Evaluation
- Table 3.3.2-8 Heating, Ventilation and Air Conditioning Systems—Summary of Aging Management Evaluation
- Table 3.3.2-9 Fuel Pool Cooling and Cleanup System—Summary of Aging Management Evaluation
- Table 3.3.2-10 Instrument Air System—Summary of Aging Management Evaluation
- Table 3.3.2-11 Reactor Equipment Cooling System—Summary of Aging Management Evaluation
- Table 3.3.2-12 Plant Drains—Summary of Aging Management Evaluation
- Table 3.3.2-13 Nitrogen System—Summary of Aging Management Evaluation

Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

- Table 3.3.2-14-1 Auxiliary Condensate Drains System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-14-2 Auxiliary Steam System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
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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. Programs are described in Appendix B. Further details are provided in the system tables.

3.3.2.1.1 Standby Liquid Control

Materials

Standby liquid control system components are constructed of the following materials.

- carbon steel
- carbon steel (coated)
- copper alloy >15% zinc or > 8% aluminum
- glass
- stainless steel

Environment

Standby liquid control system components are exposed to the following environments.

- air – indoor
- concrete
- lube oil
- sodium pentaborate solution

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 aging effects for the standby liquid control system components.

- Bolting Integrity
- External Surfaces Monitoring
- Oil Analysis
- Periodic Surveillance and Preventive Maintenance
- Water Chemistry Control – BWR

3.3.2.1.2 Control Rod Drive

Materials

Control rod drive system components are constructed of the following materials.

- carbon steel
- stainless steel

Environment

Control rod drive system components are exposed to the following environments.

- air – indoor
- gas
- treated water
- treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the control rod drive system require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for control rod drive system components.

- Bolting Integrity
- External Surfaces Monitoring
- Water Chemistry Control – BWR

3.3.2.1.3 Service Water

Materials

Service water system components are constructed of the following materials.

- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- glass

- gray cast iron
- stainless steel

Environment

Service water system components are exposed to the following environments.

- air – indoor
- condensation
- lube oil
- raw water
- soil

Aging Effects Requiring Management

The following aging effects associated with the service water system require management.

- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the service water system components.

- Bolting Integrity
- Buried Piping and Tanks Inspection
- External Surfaces Monitoring
- Oil Analysis
- Selective Leaching
- Service Water Integrity

3.3.2.1.4 Diesel Generator

Materials

Diesel generator system components are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- fiberglass
- glass

- gray cast iron
- stainless steel

Environment

Diesel generator system components are exposed to the following environments.

- air – indoor
- air – outdoor
- condensation
- exhaust gas
- lube oil
- raw water
- treated water
- treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the diesel generator system require management.

- cracking
- cracking – fatigue
- fouling
- loss of material
- loss of material – wear
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the diesel generator system components.

- Bolting Integrity
- External Surfaces Monitoring
- Oil Analysis
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Service Water Integrity
- Water Chemistry Control – Closed Cooling Water

3.3.2.1.5 Fuel Oil

Materials

Fuel oil system components are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- gray cast iron
- stainless steel

Environment

Fuel oil system components are exposed to the following environments.

- air – indoor
- air – outdoor
- fuel oil
- soil

Aging Effects Requiring Management

The following aging effects associated with the fuel oil system require management.

- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the fuel oil system components.

- Bolting Integrity
- Buried Piping and Tanks Inspection
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Fire Protection

3.3.2.1.6 Fire Protection – Water

Materials

Fire protection – water system components are constructed of the following materials.

- carbon steel
- copper alloy

- copper alloy > 15% zinc or > 8% aluminum
- gray cast iron
- plastic
- stainless steel

Environment

Fire protection – water system components are exposed to the following environments.

- air – indoor
- air – outdoor
- air – treated
- concrete
- exhaust gas
- soil
- treated water

Aging Effects Requiring Management

The following aging effects associated with the fire protection – water system require management.

- cracking – fatigue
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the fire protection – water system components.

- Aboveground Steel Tanks
- Bolting Integrity
- Buried Piping and Tanks Inspection
- External Surfaces Monitoring
- Fire Protection
- Fire Water System
- Selective Leaching

3.3.2.1.7 Halon and CO_2

Materials

Halon and CO_2 system components are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- stainless steel
- teflon

Environment

Halon and CO_2 system components are exposed to the following environments.

- air – indoor
- gas

Aging Effects Requiring Management

The following aging effects associated with the halon and CO_2 system require management.

- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the halon and CO_2 system components.

- Bolting Integrity
- Fire Protection

3.3.2.1.8 Heating, Ventilation and Air Conditioning

Materials

Heating, ventilation and air conditioning system components are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy

- elastomer
- stainless steel

Environment

Heating, ventilation and air conditioning system components are exposed to the following environments.

- air – indoor
- air – outdoor
- condensation
- treated water

Aging Effects Requiring Management

The following aging effects associated with the heating, ventilation and air conditioning system require management.

- change in material properties
- cracking
- fouling
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the heating, ventilation and air conditioning systems components.

- Bolting Integrity
- External Surfaces Monitoring
- Periodic Surveillance and Preventive Maintenance
- Water Chemistry Control – Closed Cooling Water

3.3.2.1.9 Fuel Pool Cooling and Cleanup

Materials

Fuel pool cooling and cleanup system components are constructed of the following materials.

- aluminum/boron carbide

Environment

Fuel pool cooling and cleanup system components are exposed to the following environments.

- treated water

Aging Effects Requiring Management

The following aging effects associated with the fuel pool cooling and cleanup system require management.

- loss of material

Aging Management Programs

The following aging management programs manage the aging effects for the fuel pool cooling and cleanup system components.

- Neutron Absorber Monitoring
- Water Chemistry Control – BWR

3.3.2.1.10 Instrument Air

Materials

Instrument air system components are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- stainless steel

Environment

Instrument air system components are exposed to the following environments.

- air – indoor
- air – treated
- condensation
- gas

Aging Effects Requiring Management

The following aging effects associated with the instrument air system require management.

- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the instrument air system components.

- Bolting Integrity
- External Surfaces Monitoring
- Periodic Surveillance and Preventive Maintenance

3.3.2.1.11 Reactor Equipment Cooling

Materials

Reactor equipment cooling system components are constructed of the following materials.

- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- glass
- gray cast iron
- stainless steel

Environment

Reactor equipment cooling system components are exposed to the following environments.

- air – indoor
- raw water
- treated water

Aging Effects Requiring Management

The following aging effects associated with the reactor equipment cooling system require management.

- fouling
- loss of material

- loss of material – wear
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the reactor equipment cooling system components.

- Bolting Integrity
- External Surfaces Monitoring
- Selective Leaching
- Service Water Integrity
- Water Chemistry Control – Closed Cooling Water

3.3.2.1.12 Plant Drains

Materials

Plant drains components are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- gray cast iron
- plastic
- stainless steel

Environment

Plant drains components are exposed to the following environments.

- air – indoor
- air – outdoor
- raw water
- soil

Aging Effects Requiring Management

The following aging effects associated with the plant drains require management.

- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the plant drains components.

- Bolting Integrity
- Buried Piping and Tanks Inspection
- External Surfaces Monitoring
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching

3.3.2.1.13 Nitrogen

Materials

Nitrogen system components are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- gray cast iron
- nickel alloy
- stainless steel

Environment

Nitrogen system components are exposed to the following environments.

- air – indoor
- air – outdoor
- condensation
- gas
- liquid nitrogen
- raw water
- soil

Aging Effects Requiring Management

The following aging effects associated with the nitrogen system require management.

- fouling
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the nitrogen system components.

- Bolting Integrity
- Buried Piping and Tanks Inspection
- External Surfaces Monitoring
- Periodic Surveillance and Preventive Maintenance

3.3.2.1.14 Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.3.2-13-xx tables.

Materials

Nonsafety-related components affecting safety-related systems are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- glass
- gray cast iron
- plastic
- stainless steel

Environment

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- air – indoor
- air – treated
- condensation
- fuel oil
- gas
- lube oil
- raw water
- sodium pentaborate solution
- steam
- treated water
- treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Fire Water System
- Flow-Accelerated Corrosion
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Service Water Integrity
- Water Chemistry Control – Auxiliary Systems
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Cooling Water

3.3.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 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 CNS approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.3.2.2.1 Cumulative Fatigue Damage

Where identified as an aging effect requiring management for components designed to ASME Code requirements, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). Evaluation of this TLAA is addressed in Section 4.3.

3.3.2.2.2 Reduction of Heat Transfer due to Fouling

Reduction of heat transfer due to fouling is an aging effect requiring management for stainless steel heat exchanger tubes exposed to treated water. At CNS there are no stainless steel heat exchanger tubes exposed to treated water in the auxiliary systems with an intended function of heat transfer. This item was not used.

3.3.2.2.3 Cracking due to Stress Corrosion Cracking (SCC)

1. Cracking due to SCC can occur in the stainless steel piping, piping components, and piping elements of the BWR standby liquid control (SLC) system that are exposed to sodium pentaborate solution greater than 140°F. At CNS, the sodium pentaborate solution in the SLC system does not exceed 140°F. Therefore, cracking due to SCC is not an aging effect requiring management for the SLC system. This item was not used.

2. Cracking due to SCC can occur in stainless steel heat exchanger components exposed to treated water greater than 140°F. Although there are no stainless steel heat exchanger components exposed to treated water greater than 140°F with a safety related intended function, this item is applicable to heat exchanger components included in scope under criterion 10 CFR 54.4(a)(2). Cracking for these components is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components.

3. Cracking due to SCC can occur in stainless steel diesel engine exhaust piping exposed to diesel exhaust when moisture can collect inside the component when the diesel is not in operation. At CNS, the stainless steel exhaust components are not subject to significant moisture accumulation that would allow cracking to occur. Therefore, cracking due to SCC is not an aging effect requiring management for the stainless steel diesel engine exhaust piping. This item was not used.

3.3.2.2.4 Cracking due to Stress Corrosion Cracking and Cyclic Loading

1. Cracking due to SCC and cyclic loading could occur in stainless steel PWR nonregenerative heat exchanger components exposed to treated borated water greater than 140°F in the chemical and volume control system. CNS is a BWR and does not have a nonregenerative heat exchanger exposed to treated borated water. This item was not used.

2. Cracking due to SCC and cyclic loading could occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water

greater than 140°F. CNS is a BWR and does not have a regenerative heat exchanger exposed to treated borated water. This item was not used.

3. Cracking due to SCC and cyclic loading could occur in the stainless steel pump casing of PWR high-pressure pumps in the chemical and volume control system. CNS is a BWR and does not have a chemical and volume control system. This item was not used.

3.3.2.2.5 Hardening and Loss of Strength due to Elastomer Degradation

1. Cracking and change in material properties due to elastomer degradation in elastomer flexible connections of auxiliary systems and other systems exposed to air – indoor are aging effects requiring management at CNS. These aging effects are managed by the Periodic Surveillance and Preventive Maintenance Program. This program includes visual inspections and physical manipulation of the flexible connections to confirm that the components are not experiencing any aging that would affect accomplishing their intended functions.

2. For the auxiliary systems at CNS, no credit is taken for any elastomer linings to prevent loss of material from the underlying carbon steel material. The material is identified as carbon steel for the aging management review. This item was not used.

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material due to General Corrosion

Loss of material is an aging effect requiring management for Boral spent fuel storage racks exposed to a treated water environment. This aging effect is managed by the Neutron Absorber Monitoring and Water Chemistry Control – BWR Programs.

Reduction of neutron-absorbing capacity is insignificant and requires no aging management. The potential for aging effects due to sustained irradiation of Boral was previously evaluated by the staff (BNL-NUREG-25582, dated January 1979; NUREG-1787, VC Summer Safety Evaluation Report (SER), paragraph 3.5.2.4.2, page 3-408) and determined to be insignificant. CNS plant operating experience with Boral coupons inspected in 2002 is consistent with the staff's conclusion and an aging management program is not required for this effect.

3.3.2.2.7 Loss of Material due to General, Pitting, and Crevice Corrosion

1. Steel piping and components in auxiliary systems at CNS that are exposed to lubricating oil are managed by the Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to

corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

CNS is a BWR with an inert containment atmosphere and as a result has no reactor coolant pump oil collection system.

2. CNS does not have a separate shutdown cooling system. Loss of material due to general, pitting, and crevice corrosion in carbon steel piping and components in other systems exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

3. Loss of material due to general (steel only) pitting and crevice corrosion for carbon steel and stainless steel diesel exhaust piping and components exposed to diesel exhaust in the emergency diesel generator system is managed by the Periodic Surveillance and Preventive Maintenance (PSPM) Program. This program uses periodic visual inspections to manage loss of material for these components. The carbon steel diesel exhaust piping and components in the fire protection system are managed by the Fire Protection Program. The Fire Protection Program uses visual inspections of diesel exhaust piping and components to manage loss of material. These inspections in the PSPM and Fire Protection Program will manage the aging effect of loss of material such that the intended function of the components will not be affected.

3.3.2.2.8 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)

Loss of material due to general, pitting, crevice, and MIC for carbon steel (with or without coating or wrapping) piping and components buried in soil in the auxiliary systems at CNS is managed by the Buried Piping and Tanks Inspection Program. This program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel components. Buried components will be inspected when excavated during maintenance. An inspection will be performed within ten years of entering the period of extended operation, unless an opportunistic inspection occurred within this ten-year period. This program will manage the aging effect of loss of material such that the intended function of the components will not be affected.

3.3.2.2.9 Loss of Material due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling

1. Loss of material due to general, pitting, crevice, and MIC for carbon steel piping and components exposed to fuel oil is an aging effect requiring management at CNS and these components are managed by the Diesel Fuel Monitoring Program. This program includes sampling and monitoring of fuel oil quality to ensure they remain within the limits specified by the American Society for Testing and Materials (ASTM) standards. Maintaining parameters within limits ensures that significant loss of material will not occur. The One-Time Inspection Program will use visual inspections or nondestructive examinations of representative samples to confirm that the Diesel Fuel Monitoring Program has been effective at managing aging effects for components that credit this program.

2. Loss of material due to general, pitting, crevice and MIC for carbon steel heat exchanger components exposed to lubricating oil is an aging effect requiring management in the auxiliary systems at CNS and is managed by the Oil Analysis Program. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.3.2.2.10 Loss of Material due to Pitting and Crevice Corrosion

1. Loss of material due to pitting and crevice corrosion could occur in steel piping with elastomer lining or stainless steel cladding that is exposed to treated water and treated borated water if the cladding or lining is degraded. For the auxiliary systems at CNS, no credit is taken for elastomer linings or stainless steel cladding to prevent loss of material from the underlying carbon steel material when exposed to treated water; the material is identified as carbon steel for the aging management review. The Water Chemistry Control – BWR Program manages loss of material in steel components exposed to treated water. The effectiveness of the program will be confirmed by the One-Time Inspection Program.

2. Loss of material due to pitting and crevice corrosion for stainless steel and aluminum piping and components and for stainless steel heat exchanger components exposed to treated water in the auxiliary systems at CNS is managed by the Water Chemistry Control – BWR Program. The effectiveness of the program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

3. Loss of material due to pitting and crevice corrosion for copper alloy components exposed to condensation (external) in the HV and other systems is managed by the External Surfaces Monitoring Program. The External Surfaces Monitoring Program includes periodic visual inspections to manage the aging effect of loss of material such that the intended function of the components will not be affected.

4. Loss of material due to pitting and crevice corrosion for copper alloy components exposed to lubricating oil in auxiliary systems at CNS is managed by the Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

5. There are no aluminum components exposed to condensation in the HV systems at CNS. Loss of material due to pitting and crevice corrosion for stainless steel components exposed to condensation is an aging effect requiring management for HV and other systems at CNS. The Bolting Integrity and External Surfaces Monitoring Programs will manage loss of material in stainless steel components exposed to condensation. These programs include a periodic visual inspections to manage loss of material of the components.

6. Loss of material due to pitting and crevice corrosion could occur for copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. At CNS, there are no copper alloy components exposed to condensation in the fire protection systems. However, this item can be applied to copper alloy components exposed to internal condensation in other systems. The Periodic Surveillance and Preventive Maintenance Program will manage loss of material in copper alloy components exposed internally to condensation through the use of periodic visual inspections.

7. Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. At CNS there are no stainless steel piping components exposed to soil in the auxiliary systems. This item was not used.

8. Loss of material due to pitting and crevice corrosion for stainless steel piping and components of the standby liquid control system exposed to sodium pentaborate solution is managed at CNS by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

3.3.2.2.11 Loss of Material due to Pitting, Crevice and Galvanic Corrosion

Loss of material due to pitting, crevice, and galvanic corrosion for copper alloy piping and components exposed to treated water in the auxiliary and other systems at CNS is managed by the Water Chemistry Control – BWR Program. The effectiveness of the program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

3.3.2.2.12 Loss of Material due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

1. Loss of material due to pitting, crevice, and MIC in stainless steel and copper alloy piping and components exposed to fuel oil is an aging effect requiring management at CNS and these components are managed by the Diesel Fuel Monitoring and Fire Protection Programs. There are no aluminum components exposed to fuel oil in the auxiliary systems. The Diesel Fuel Monitoring Program includes sampling and monitoring of fuel oil quality to ensure it remains within the limits specified by the ASTM standards. Maintaining parameters within limits ensures that significant loss of material will not occur. The One-Time Inspection Program will use visual inspections or nondestructive examinations of representative samples to confirm that the Diesel Fuel Monitoring Program has been effective at managing aging effects for components that credit this program. For the diesel driven fire pump fuel supply line, the Fire Protection Program uses periodic inspections to supplement the Diesel Fuel Monitoring Program.

2. Loss of material due to pitting, crevice, and MIC in stainless steel piping and components exposed to lubricating oil is managed by the Oil Analysis Program which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.3.2.2.13 Loss of Material due to Wear

Loss of material due to wear could occur in the elastomer seals and components exposed to air – indoor uncontrolled (internal or external). Wear is the removal of surface layers due to relative motion between two surfaces. In the CNS auxiliary systems, this specific aging effect for elastomers is not applicable since the expansion joints are fixed at both ends and do not contact any other components such that wear could occur. Where the aging effects of change in material properties and cracking are identified for elastomer components, they are managed by the Periodic

Surveillance and Preventive Maintenance Program. This item was not used for auxiliary systems.

3.3.2.2.14 Cracking due to Underclad Cracking

Cracking due to underclad cracking could occur for PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. CNS is a BWR and has no charging pumps. This item was not used.

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of CNS quality assurance procedures and administrative controls for aging management programs.

3.3.2.3 Time-Limited Aging Analysis

The only time-limited aging analysis identified for auxiliary systems components is metal fatigue. This is evaluated in Section 4.3.

3.3.3 Conclusion

The auxiliary system 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 the effects of aging on auxiliary system components are identified in Section 3.3.2.1 and in the following tables. 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 demonstrations provided in Appendix B, the effects of aging associated with the auxiliary system components 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 3.3.1
Summary of Aging Management Programs for the Auxiliary Systems
Evaluated in Chapter VII of NUREG-1801

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

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	TLAA to be evaluated for structural girders of cranes. See the Standard Review Plan, Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA	This line item was not used. Steel cranes are evaluated as structural components in Section 3.5.
3.3.1-2	Steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air – indoor uncontrolled, treated borated water or treated water	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA. See Section 3.3.2.2.1.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-3	Stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	This item was not used. There are no stainless steel heat exchanger tubes exposed to treated water in the auxiliary systems with an intended function of heat transfer. See Section 3.3.2.2.2.
3.3.1-4	Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution >60°C (> 140°F)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	This item was not used. The operating temperature of the standby liquid control system is below the 140°F threshold for cracking in stainless steel. See Section 3.3.2.2.3 item 1.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-5	Stainless steel and stainless clad steel heat exchanger components exposed to treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Plant specific	Yes, plant specific	Cracking in stainless steel heat exchanger components exposed to treated water > 140°F is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are in scope under criterion 10 CFR 54.4(a)(2) and are listed in series 3.3.2-14-xx tables. See Section 3.3.2.2.3 item 2.
3.3.1-6	Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust	Cracking due to stress corrosion cracking	Plant specific	Yes, plant specific	This item was not used. The stainless steel diesel exhaust components are not subject to significant moisture accumulation, which precludes cracking due to stress corrosion cracking. See Section 3.3.2.2.3 item 3.
3.3.1-7	PWR only				
3.3.1-8	PWR only				
3.3.1-9	PWR only				

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-10	High-strength steel closure bolting exposed to air with steam or water leakage.	Cracking due to stress corrosion cracking, cyclic loading	Bolting Integrity The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance.	Yes, if the bolts are not replaced during maintenance	This item was not used. High strength steel bolting is not used in the auxiliary systems.
3.3.1-11	Elastomer seals and components exposed to air – indoor uncontrolled (internal/external)	Hardening and loss of strength due to elastomer degradation	Plant specific	Yes, plant specific	The change in material properties of elastomer components will be managed by the Periodic Surveillance and Preventive Maintenance Program. See Section 3.3.2.2.5 item 1.
3.3.1-12	Elastomer lining exposed to treated water or treated borated water	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant specific	This item was not used. No credit is taken for any elastomer linings to prevent loss of material from the underlying carbon steel. See Section 3.3.2.2.5 item 2.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-13	Boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water	Reduction of neutron-absorbing capacity and loss of material due to general corrosion	Plant specific	Yes, plant specific	The Neutron Absorber Monitoring and Water Chemistry Control – BWR Programs manage loss of material for Boral. Reduction of neutron-absorbing capacity is insignificant and requires no aging management. See Section 3.3.2.2.6.
3.3.1-14	Steel piping, piping component, and piping elements exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages loss of material in steel components. The One-Time Inspection Program will be used to verify the effectiveness of the Oil Analysis Program. See Section 3.3.2.2.7 item 1.
3.3.1-15	Steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	This item was not used. Reactor coolant pump oil collection components are not required. CNS operates with an inerted containment. See Section 3.3.2.2.7 item 1.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-16	Steel reactor coolant pump oil collection system tank exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank	Yes, detection of aging effects is to be evaluated	This item was not used. Reactor coolant pump oil collection components are not required. CNS operates with an inerted containment. See Section 3.3.2.2.7 item 1.
3.3.1-17	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in steel components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. See Section 3.3.2.2.7 item 2.
3.3.1-18	Stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust	Loss of material/ general (steel only), pitting and crevice corrosion	Plant specific	Yes, plant specific	The Periodic Surveillance and Preventive Maintenance and Fire Protection Programs will manage loss of material in steel and stainless steel components exposed to diesel exhaust. See Section 3.3.2.2.7 item 3.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-19	Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	Consistent with NUREG-1801. The loss of material of buried steel components will be managed by the Buried Piping and Tanks Inspection Program. See Section 3.3.2.2.8.
3.3.1-20	Steel piping, piping components, piping elements, and tanks exposed to fuel oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Diesel Fuel Monitoring Program manages loss of material in steel components. The One-Time Inspection Program will be used to verify the effectiveness of the Diesel Fuel Monitoring Program. See Section 3.3.2.2.9 item 1.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-21	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages loss of material in steel heat exchanger components. The One-Time Inspection Program will be used to verify the effectiveness of the Oil Analysis Program. See Section 3.3.2.2.9 item 2.
3.3.1-22	Steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water and treated borated water	Loss of material due to pitting and crevice corrosion (only for steel after lining/ cladding degradation)	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	This item was not used. No credit is taken for any elastomer linings or stainless steel cladding to prevent loss of material from the underlying carbon steel material. See Section 3.3.2.2.10 item 1.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-23	Stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in stainless steel heat exchanger components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are in scope under criterion 10 CFR 54.4(a)(2) and are listed in series 3.3.2-14-xx tables. See Section 3.3.2.2.10 item 2.
3.3.1-24	Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in stainless steel and aluminum components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. See Section 3.3.2.2.10 item 2.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-25	Copper alloy HVAC piping, piping components, piping elements exposed to condensation (external)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The External Surfaces Monitoring Program manages loss of material in copper alloy components exposed to condensation. See Section 3.3.2.2.10 item 3.
3.3.1-26	Copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages loss of material in copper alloy components. The One-Time Inspection Program will be used to verify the effectiveness of the Oil Analysis Program. See Section 3.3.2.2.10 item 4.
3.3.1-27	Stainless steel HVAC ducting and aluminum HVAC piping, piping components and piping elements exposed to condensation	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The Bolting Integrity and External Surfaces Monitoring Programs manage loss of material in stainless steel components exposed to condensation. There are no aluminum components exposed to condensation in the auxiliary systems. See Section 3.3.2.2.10 item 5.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-28	Copper alloy fire protection piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The Periodic Surveillance and Preventive Maintenance Program will manage loss of material in copper alloy components exposed to condensation. See Section 3.3.2.2.10 item 6.
3.3.1-29	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	This item was not used. There are no buried stainless steel components in the auxiliary systems. See Section 3.3.2.2.10 item 7.
3.3.1-30	Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in stainless steel components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. See Section 3.3.2.2.10 item 8.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-31	Copper alloy piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The loss of material in copper alloy components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are in the ESF systems in series 3.2.2-xx tables, and components in scope under criterion 10 CFR 54.4(a)(2), listed in series 3.2.2-8-xx and 3.3.2-14-xx tables. See Section 3.3.2.2.11.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-32	Stainless steel, aluminum and copper alloy piping, piping components, and piping elements exposed to fuel oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Fuel Oil Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Diesel Fuel Monitoring Program manages loss of material in stainless steel and copper alloy components. The One-Time Inspection Program will be used to verify the effectiveness of the Diesel Fuel Monitoring Program. The Fire Protection Program supplements the Diesel Fuel Monitoring Program for stainless steel and copper alloy components exposed to fuel oil in the fire protection system. There are no aluminum components exposed to fuel oil in the auxiliary systems. See Section 3.3.2.2.12 item 1.
3.3.1-33	Stainless steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages loss of material in stainless steel components. The One-Time Inspection Program will be used to verify the effectiveness of the Oil Analysis Program. See Section 3.3.2.2.12 item 2.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-34	Elastomer seals and components exposed to air – indoor uncontrolled (internal or external)	Loss of material due to Wear	Plant specific	Yes, plant specific	This item was not used. There are no elastomer components with loss of material due to wear as an applicable aging effect. See Section 3.3.2.2.13.
3.3.1-35	PWR only				
3.3.1-36	Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water	Reduction of neutron-absorbing capacity due to boraflex degradation	Boraflex Monitoring	No	This item was not used. Boraflex is not used in the CNS spent fuel storage racks.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-37	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	BWR Reactor Water Cleanup System	No	Cracking of stainless steel components of the reactor water cleanup system is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.3.2-14-xx tables. The BWR Reactor Water Cleanup System Program is not credited for license renewal. CNS has replaced portions of the RWCU system piping with material that is not susceptible to IGSCC. CNS has complied with the requirements of NRC Generic Letter (GL) 89-10 and has performed the inspections specified by NRC GL 88-01 with no significant indications of IGSCC on piping that was not replaced. The Water Chemistry Control – BWR Program is used in lieu of the reactor water cleanup system program to manage cracking.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-38	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	The Water Chemistry Control – BWR Program manages cracking of stainless steel components. None of the auxiliary system components are within the scope of the BWR Stress Corrosion Cracking Program (all relevant components are included in the reactor vessel, internals and reactor coolant systems). The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program.
3.3.1-39	Stainless steel BWR spent fuel storage racks exposed to treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Water Chemistry	No	This item was not used. There are no stainless steel spent fuel storage components with intended functions exposed to treated water > 140°F.
3.3.1-40	Steel tanks in diesel fuel oil system exposed to air - outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Consistent with NUREG-1801 for some tanks. The Aboveground Steel Tanks Program will manage loss of material for steel fire water storage tanks exposed to outdoor air. The External Surfaces Monitoring Program will manage loss of material for the exposed (not buried) portion of the steel nitrogen supply vaporizer tank.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-41	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	This item was not used. High-strength steel closure bolting is not used in the auxiliary systems.
3.3.1-42	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Bolting Integrity	No	This line item was not used. Loss of material of steel closure bolting was addressed by other items including 3.3.1-43, 3.3.1-44 and 3.3.1-58.
3.3.1-43	Steel bolting and closure bolting exposed to air – indoor uncontrolled (external) or air – outdoor (External)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Consistent with NUREG-1801. The Bolting Integrity Program manages loss of material for steel bolting exposed to indoor or outdoor air.
3.3.1-44	Steel compressed air system closure bolting exposed to condensation	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Consistent with NUREG-1801. The Bolting Integrity Program manages loss of material for steel bolting exposed to condensation.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-45	Steel closure bolting exposed to air – indoor uncontrolled (external)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Loss of preload is a design-driven effect and not an aging effect requiring management. Bolting at CNS is standard grade B7 low alloy steel, or similar material, except in rare specialized applications such as where stainless steel bolting is utilized. Loss of preload due to stress relaxation (creep) would only be a concern in very high temperature applications (> 700°F), as stated in the ASME Code, Section II, Part D, Table 4. No bolting operates at > 700°F. Therefore, loss of preload due to stress relaxation (creep) is not an applicable aging effect for auxiliary systems. Other issues such as gasket creep and self loosening that may result in pressure boundary joint leakage are improper design or maintenance issues. Improper bolting application (design) and maintenance issues are current plant operational concerns and not related to aging effects or mechanisms that require management during the period of extended operation. (continued below)

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					Nevertheless, the Bolting Integrity Program manages loss of preload for all bolting in the auxiliary systems. As described in the Bolting Integrity Program, CNS has taken actions to address NUREG–1339, *Resolution to Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*. These actions include implementation of good bolting practices in accordance with EPRI NP-5067, Good Bolting Practices. Proper joint preparation and make-up in accordance with industry standards is expected to preclude loss of preload. This has been confirmed by operating experience at CNS.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-46	Stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 for components of closed cooling systems. The Water Chemistry Control – Closed Cooling Water Program manages cracking for stainless steel components. For the reactor recirculation pump cover thermal barrier (Table 3.1.2-3), the Inservice Inspection – ISI Program supplements the Water Chemistry Control – Closed Cooling Water Program. For other systems with controlled water chemistry, the Water Chemistry Control – Auxiliary Systems Program manages cracking for stainless steel components. The One-Time Inspection Program for Water Chemistry will use inspections or non-destructive examinations of representative samples to verify that these water chemistry programs have been effective at managing aging effects. The Service Water Integrity Program uses inspections or non-destructive examinations to manage cracking for the stainless steel diesel generator heat exchanger tubes (exposed to closed cycle cooling water on the shell side of the heat exchanger).

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-47	Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 for components of closed cooling systems such as the reactor equipment cooling and diesel generator systems. The Water Chemistry Control – Closed Cooling Water Program manages loss of material for steel components. For other systems with controlled water chemistry, such as the auxiliary steam and auxiliary condensate drains systems, the Water Chemistry Control – Auxiliary Systems Program manages loss of material for steel components. The One-Time Inspection Program for Water Chemistry will use inspections or non-destructive examinations of representative samples to verify that these water chemistry programs have been effective at managing aging effects.
3.3.1-48	Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Water Chemistry Control – Closed Cooling Water Program manages loss of material for steel heat exchanger components. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-49	Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water	Loss of material due to microbiologically influenced corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Water Chemistry Control – Closed Cooling Water Program manages loss of material for stainless steel heat exchanger components. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program.
3.3.1-50	Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 for components of closed cooling systems such as the reactor equipment cooling and diesel generator systems. The Water Chemistry Control – Closed Cooling Water Program manages loss of material for stainless steel components. For other systems with controlled water chemistry, such as the auxiliary steam and auxiliary condensate drains systems, the Water Chemistry Control – Auxiliary Systems Program manages loss of material for stainless steel components. The One-Time Inspection Program for Water Chemistry will use inspections or non-destructive examinations of representative samples to verify that these water chemistry programs have been effective at managing aging effects.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-51	Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 for components of closed cooling systems such as the reactor equipment cooling and diesel generator systems. The Water Chemistry Control – Closed Cooling Water Program manages loss of material for copper alloy components. For other systems with controlled water chemistry, such as the auxiliary steam and auxiliary condensate drains systems, the Water Chemistry Control – Auxiliary Systems Program manages loss of material for copper alloy components. The One-Time Inspection Program for Water Chemistry will use inspections or non-destructive examinations of representative samples to verify that these water chemistry programs have been effective at managing aging effects.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-52	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Water Chemistry Control – Closed Cooling Water Program manages reduction of heat transfer for steel, stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program.
3.3.1-53	Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to general and pitting corrosion	Compressed Air Monitoring	No	The Periodic Surveillance and Preventive Maintenance Program will manage loss of material in steel components exposed to internal condensation through the periodic use of visual inspections or other NDE techniques.
3.3.1-54	Stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation	Loss of material due to pitting and crevice corrosion	Compressed Air Monitoring	No	The Periodic Surveillance and Preventive Maintenance Program will manage loss of material in stainless steel components of the diesel generator system exposed to internal condensation through the periodic use of visual inspections. For components of the station air system, the One-Time Inspection Program will confirm the absence of significant loss of material using visual inspections or other NDE techniques.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-55	Steel ducting closure bolting exposed to air – indoor uncontrolled (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	This line item was not used. Loss of material of steel closure bolting was addressed by other items including 3.3.1-43, 3.3.1-44 and 3.3.1-58.
3.3.1-56	Steel HVAC ducting and components external surfaces exposed to air – indoor uncontrolled (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801 for most HV system components. The External Surfaces Monitoring Program manages loss of material for external surfaces of steel components. The Periodic Surveillance and Preventive Maintenance Program will periodically inspect steel HV system components not readily accessible for external surfaces monitoring.
3.3.1-57	Steel piping and components external surfaces exposed to air – indoor uncontrolled (External)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring Program manages loss of material for external surfaces of steel components.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-58	Steel external surfaces exposed to air – indoor uncontrolled (external), air - outdoor (external), and condensation (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801 for most steel components. The External Surfaces Monitoring Program manages loss of material for external surfaces. For some steel components of the halon and CO_2 systems, the Fire Protection Program manages loss of material using periodic visual inspections. The Periodic Surveillance and Preventive Maintenance Program periodically inspects external steel surfaces of portable pumps used for flood control, to manage loss of material.
3.3.1-59	Steel heat exchanger components exposed to air – indoor uncontrolled (external) or air - outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring Program manages loss of material for external surfaces of steel heat exchanger components.
3.3.1-60	Steel piping, piping components, and piping elements exposed to air - outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring Program manages loss of material for external surfaces of steel components.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-61	Elastomer fire barrier penetration seals exposed to air – outdoor or air – indoor uncontrolled	Increased hardness, shrinkage and loss of strength due to weathering	Fire Protection	No	This line item was not used in the auxiliary systems tables. Fire barrier seals are evaluated as structural components in Section 3.5. Cracking and the change in material properties of elastomer seals are managed by the Fire Protection Program.
3.3.1-62	Aluminum piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion	Fire Protection	No	The Periodic Surveillance and Preventive Maintenance will use visual or other NDE techniques to confirm the absence of significant loss of material for aluminum components exposed to waste water which is considered to be raw water.
3.3.1-63	Steel fire rated doors exposed to air – outdoor or air – indoor uncontrolled	Loss of material due to Wear	Fire Protection	No	This line item was not used in the auxiliary systems tables. Steel fire doors are evaluated as structural components in Section 3.5. The loss of material for fire doors is managed by the Fire Protection Program.
3.3.1-64	Steel piping, piping components, and piping elements exposed to fuel oil	Loss of material due to general, pitting, and crevice corrosion	Fire Protection and Fuel Oil Chemistry	No	This item was not used. There are no steel components in the diesel fire pump fuel supply piping.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-65	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	Fire Protection and Structures Monitoring Program	No	This line item was not used in the auxiliary systems tables. Reinforced concrete structural fire barriers are evaluated as structural components in Section 3.5. Reaction with aggregates is not an applicable aging mechanism for concrete for these groups of structures at CNS. Aggregates were selected locally and were in accordance with specifications and materials conforming to American Concrete Institute (ACI) and ASTM standards at the time of construction, which are in accordance with the recommendations in ACI 201.2R-77 for concrete durability. The CNS indoor air environment is not conducive to aggressive chemical attack of concrete. Nonetheless, the Fire Protection and Structures Monitoring Programs will be used to confirm the absence of significant aging effects for the period of extended operation.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-66	Reinforced concrete structural fire barriers – walls, ceilings and floors exposed to air – outdoor	Concrete cracking and spalling due to freeze thaw, aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	This line item was not used in the auxiliary systems tables. Reinforced concrete structural fire barriers are evaluated as structural components in Section 3.5. Concrete cracking and spalling due to freeze thaw and reaction with aggregates is not an applicable aging mechanism at CNS. Aggregates were selected in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction, which are in accordance with the recommendations in ACI 201.2R-77 for concrete durability. CNS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/ cement ratios were within the limits provided in ACI 318 63, and air entrainment percentages were within the range prescribed in NUREG-1801. The CNS outdoor air environment is not conducive to aggressive chemical attack. Nonetheless, the Fire Protection and Structures Monitoring Programs will confirm the absence of significant aging effects for the period of extended operation.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-67	Reinforced concrete structural fire barriers – walls, ceilings and floors exposed to air – outdoor or air - indoor uncontrolled	Loss of material due to corrosion of embedded steel	Fire Protection and Structures Monitoring Program	No	This line item was not used. Reinforced concrete structural fire barriers are evaluated as structural components in Section 3.5.
3.3.1-68	Steel piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Fire Water System	No	Consistent with NUREG-1801 for fire protection system components. The loss of material in steel components exposed to raw water is managed by the Fire Water System Program. For steel components of the potable water system, also exposed to treated but unmonitored (raw) water, the Periodic Surveillance and Preventive Maintenance Program manages loss of material by mean of periodic visual inspections.
3.3.1-69	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion, and fouling	Fire Water System	No	Consistent with NUREG-1801. The loss of material in stainless steel components exposed to raw water is managed by the Fire Water System Program.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-70	Copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling	Fire Water System	No	Consistent with NUREG-1801. The loss of material in copper alloy components exposed to raw water is managed by the Fire Water System Program.
3.3.1-71	Steel piping, piping components, and piping elements exposed to moist air or condensation (Internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	The Periodic Surveillance and Preventive Maintenance Program manages loss of material for steel components exposed to moist air or condensation using periodic visual inspections.
3.3.1-72	Steel HVAC 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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	The Periodic Surveillance and Preventive Maintenance Program manages loss of material for steel components exposed to condensation using periodic visual inspections or other NDE techniques.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-73	Steel crane structural girders in load handling system exposed to air-indoor uncontrolled (external)	Loss of material due to general corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	This line item was not used in the auxiliary systems tables. Steel crane structural girders are evaluated as structural components in Section 3.5. Loss of material for steel crane structural components is managed by the Periodic Surveillance and Preventive Maintenance and Structures Monitoring Programs using periodic visual inspections.
3.3.1-74	Steel cranes - rails exposed to air – indoor uncontrolled (external)	Loss of material due to Wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	This line item was not used. Steel crane rails are evaluated as structural components in Section 3.5.
3.3.1-75	Elastomer seals and components exposed to raw water	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Open-Cycle Cooling Water System	No	This line item was not used. There are no elastomeric components exposed to raw water included in the scope of license renewal.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-76	Steel piping, piping components, and piping elements (without lining/ coating or with degraded lining/ coating) exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801 for most service water system components exposed to raw water. The Service Water Integrity Program manages loss of material in steel components other than bolting. Loss of material in steel bolting in the service water system is managed by the Bolting Integrity Program. For other components exposed to untreated or unmonitored water evaluated as raw water, the Periodic Surveillance and Preventive Maintenance Program uses periodic visual inspections to manage loss of material.
3.3.1-77	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Service Water Integrity Program manages loss of material for steel heat exchanger components exposed to raw water.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-78	Stainless steel, nickel alloy, and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion	Open-Cycle Cooling Water System	No	This line was not used. There are no nickel alloy component exposed to raw water in the auxiliary systems. Stainless steel and copper alloy components exposed to raw water are addressed in other items including 3.3.1-79 and 3.3.1-81.
3.3.1-79	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801 for most components exposed to raw water from the service water system. The Service Water Integrity Program manages loss of material in stainless steel components. For other stainless steel components exposed to untreated or unmonitored water evaluated as raw water, the Periodic Surveillance and Preventive Maintenance or One-Time Inspection Program will manage loss of material or confirm the aging effect is insignificant using visual inspections or other NDE techniques.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-80	Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Service Water Integrity Program manages loss of material in stainless steel components exposed to raw water. There are no copper alloy components exposed to raw water in the diesel generator system.
3.3.1-81	Copper alloy piping, piping components, and piping elements, exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801 for service water system components exposed to raw water. The Service Water Integrity Program manages loss of material in copper alloy components. For other components exposed to untreated or unmonitored water evaluated as raw water, the Periodic Surveillance and Preventive Maintenance Program manages loss of material using periodic visual inspections.
3.3.1-82	Copper alloy heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	This item was not used. There are no copper alloy heat exchanger components exposed to raw water in the auxiliary systems.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-83	Stainless steel and copper alloy heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801 for heat exchanger tubes exposed to service water. The Service Water Integrity Program manages reduction of heat transfer in heat exchanger tubes exposed to service water. For other components exposed to untreated or unmonitored water evaluated as raw water, the Periodic Surveillance and Preventive Maintenance Program manages reduction of heat transfer using periodic visual inspections.
3.3.1-84	Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to raw water, treated water, or closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. The Selective Leaching Program will manage loss of material in copper alloy > 15% zinc or > 8% aluminum components exposed to all types of water.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-85	Gray cast iron piping, piping components, and piping elements exposed to soil, raw water, treated water, or closed-cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. The Selective Leaching Program will manage loss of material in gray cast iron components exposed to soil and all types of water.
3.3.1-86	Structural steel (new fuel storage rack assembly) exposed to air – indoor uncontrolled (external)	Loss of material due to general, pitting, and crevice corrosion	Structures Monitoring Program	No	This line item was not used. The new fuel storage racks, which are made of aluminum, are evaluated as structural components in Section 3.5.
3.3.1-87	PWR only				
3.3.1-88	PWR only				
3.3.1-89	PWR only				
3.3.1-90	PWR only				
3.3.1-91	PWR only				
3.3.1-92	Galvanized steel piping, piping components, and piping elements exposed to air – indoor uncontrolled	None	None	NA - No AEM or AMP	This item was not used. Galvanized steel surfaces are evaluated as steel for the auxiliary systems.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-93	Glass piping elements exposed to air, air – indoor uncontrolled (external), fuel oil, lubricating oil, raw water, treated water, and treated borated water	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.3.1-94	Stainless steel and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for stainless steel components. There are no nickel alloy components exposed to air – indoor uncontrolled in the auxiliary systems.
3.3.1-95	Steel and aluminum piping, piping components, and piping elements exposed to air – indoor controlled (external)	None	None	NA - No AEM or AMP	This item was not used. There are no steel or aluminum components exposed to indoor air controlled in the auxiliary systems. All indoor air environments are conservatively considered to be uncontrolled.

Table 3.3.1: Auxiliary Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-96	Steel and stainless steel piping, piping components, and piping elements in concrete	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for stainless steel components. There are no (mechanical) steel components exposed to concrete in the auxiliary systems.
3.3.1-97	Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.3.1-98	Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.3.1-99	PWR only				

Notes for Tables 3.3.2-1 through 3.3.2-14-29

Generic notes

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program 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 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes

301. The One-Time Inspection Program will verify effectiveness of the Water Chemistry Control – BWR Program.

302. The One-Time Inspection Program will verify effectiveness of the Oil Analysis and Diesel Fuel Monitoring Programs.

303. This environment is steam produced from treated water that is controlled by the Water Chemistry Control – Auxiliary Systems Program. Although this environment does not directly compare with any NUREG-1801 defined environment, the steam is considered equivalent to the NUREG-1801 steam environment for this comparison. The One-Time Inspection Program will verify effectiveness of the Water Chemistry Control – Auxiliary Systems Program.

304. This treated water environment includes water that has been treated but is not maintained by a chemistry control program. It is conservatively considered raw water for this comparison.

305. This steam or treated water environment is controlled by the Water Chemistry Control – Auxiliary Systems Program. Although this environment does not directly compare with any NUREG-1801 defined environment, it is considered the equivalent of steam or treated water for the evaluation of cracking due to fatigue.

306. This treated water environment is controlled by the Water Chemistry Control – Auxiliary Systems Program. Although this environment does not directly compare with any NUREG-1801 defined environment, it approximates the NUREG-1801 defined closed cycle cooling water environment.

307. This treated water environment is controlled by the Water Chemistry Control – Auxiliary Systems Program. Although this environment does not directly compare with any NUREG-1801 defined environment, it is considered the equivalent of treated water for the evaluation of loss of material due to flow accelerated corrosion.

308. The material for this component is carbon steel coated with a phenolic resin. The phenolic resin coating is not credited in the determination of aging effects.

309. Since loss of preload is not significantly dependent on environment, the environment given in this line is considered equivalent to the NUREG-1801 defined environments of air with reactor coolant leakage or air indoor uncontrolled for the evaluation of this aging effect.

310. This environment is steam produced from treated water that is controlled by the Water Chemistry Control – Auxiliary Systems Program. Although this environment does not directly compare with any NUREG-1801 defined environment, the steam is considered equivalent to the NUREG-1801 steam environment for this comparison.

311. This treated water environment is the jacket cooling water for the DG.

312. For components of the diesel fire pump fuel supply line, the Fire Protection Program supplements the Diesel Fuel Monitoring Program.

Table 3.3.2-1
Standby Liquid Control System
Summary of Aging Management Evaluation

Table 3.3.2-1: Standby Liquid Control System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel (coated)	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A, 308
Accumulator	Pressure boundary	Carbon steel (coated)	Sodium pentaborate solution (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	--	--	F, 308
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Heater housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	C
Heater housing	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-1: Standby Liquid Control System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Instrument snubber	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Level gauge	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Level gauge	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-10 (AP-47)	3.3.1-26	C, 302
Level gauge	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Level gauge	Pressure boundary	Glass	Lube oil (int)	None	None	VII.J-10 (AP-15)	3.3.1-93	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Pump casing	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301

Table 3.3.2-1: Standby Liquid Control System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tank	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tank	Pressure boundary	Stainless steel	Concrete (ext)	None	None	VII.J-17 (AP-19)	3.3.1-96	A
Tank	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Thermowell	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-1: Standby Liquid Control System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301

Table 3.3.2-2
Control Rod Drive System
Summary of Aging Management Evaluation

Table 3.3.2-2: Control Rod Drive System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Accumulator	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Accumulator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Accumulator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Accumulator	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309

Table 3.3.2-2: Control Rod Drive System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter	Filtration	Stainless steel	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Filter	Filtration	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Filter	Filtration	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Filter	Filtration	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301

Table 3.3.2-2: Control Rod Drive System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Rupture disk	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Rupture disk	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301

Table 3.3.2-2: Control Rod Drive System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301

Table 3.3.2-3
Service Water System
Summary of Aging Management Evaluation

Table 3.3.2-3: Service Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Blank flange	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Blank flange	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D-1 (A-103)	3.3.1-44	C
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Bolting Integrity	VII.C1-19 (A-38)	3.3.1-76	E
Bolting	Pressure boundary	Carbon steel	Raw water (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.F1-1 (A-09)	3.3.1-27	E
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309

Table 3.3.2-3: Service Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flow element	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Flow element	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Flow glass	Pressure boundary	Glass	Condensation (ext)	None	None	--	--	G
Flow glass	Pressure boundary	Glass	Raw water (int)	None	None	VII.J-11 (AP-50)	3.3.1-93	A
Flow glass	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Flow glass	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.C1-18 (A-01)	3.3.1-19	A
Piping	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E

Table 3.3.2-3: Service Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Pump casing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Pump casing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Restriction orifice	Pressure boundary Flow control	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Restriction orifice	Pressure boundary Flow control	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E

Table 3.3.2-3: Service Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice	Pressure boundary Flow control	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Strainer	Filtration	Stainless steel	Raw water (ext)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Strainer	Filtration	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Strainer housing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Thermowell	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Thermowell	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Tubing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Tubing	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-9 (A-44)	3.3.1-81	A

Table 3.3.2-3: Service Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Valve body	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Valve body	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-9 (A-44)	3.3.1-81	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-8 (AP-47)	3.3.1-26	A, 302

Table 3.3.2-3: Service Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Selective Leaching	VII.C1-10 (A-47)	3.3.1-84	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-9 (A-44)	3.3.1-81	A
Valve body	Pressure boundary	Gray cast iron	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Selective Leaching	VII.C1-11 (A-51)	3.3.1-85	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A

Table 3.3.2-4
Diesel Generator System
Summary of Aging Management Evaluation

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Accumulator	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I-1 (AP-28)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	--	--	G
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Expansion joint	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Expansion joint	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Expansion joint	Pressure boundary	Stainless steel	Exhaust gas (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-2 (A-27)	3.3.1-18	E
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-20 (AP-30)	3.3.1-14	A, 302
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2-3 (AP-41)	3.3.1-59	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-5 (A-64)	3.3.1-77	C

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (fins)	Heat transfer	Aluminum	Air – indoor (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	--	--	H
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2-3 (AP-41)	3.3.1-59	A
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2-3 (AP-41)	3.3.1-59	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-5 (AP-39)	3.3.1-21	A, 302
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-1 (A-63)	3.3.1-48	D
Heat exchanger (shell)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-4: Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (shell)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-10 (AP-47)	3.3.1-26	C, 302
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% Zn or > 8% Al	Lube oil (ext)	Fouling	Oil Analysis	VIII.G-8 (SP-53)	3.4.1-10	C, 302
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Fouling	Water Chemistry Control – Closed Cooling Water	VII.C2-2 (AP-80)	3.3.1-52	D
Heat exchanger (tubes)	Heat transfer	Stainless steel	Air – indoor (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	--	--	G
Heat exchanger (tubes)	Heat transfer	Stainless steel	Lube oil (ext)	Fouling	Oil Analysis	VIII.G-12 (SP-62)	3.4.1-10	C, 302
Heat exchanger (tubes)	Heat transfer	Stainless steel	Raw water (int)	Fouling	Service Water Integrity	VII.H2-6 (AP-61)	3.3.1-83	A
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water > 140°F (ext)	Fouling	Water Chemistry Control – Closed Cooling Water	VII.C2-3. (AP-63)	3.3.1-52	D

Table 3.3.2-4: Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2-10 (AP-47)	3.3.1-26	C, 302
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2-12 (AP-43)	3.3.1-84	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.F1-8 (AP-34)	3.3.1-51	D
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	C
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Lube oil (ext)	Cracking	Oil Analysis	--	--	H
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2-17 (AP-59)	3.3.1-33	C, 302
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Lube oil (ext)	Loss of material-wear	Service Water Integrity	--	--	H
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Raw water (int)	Cracking	Service Water Integrity	--	--	H

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.H2-18 (AP-55)	3.3.1-80	C
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Cracking	Service Water Integrity	VII.C2-11 (AP-60)	3.3.1-46	E, 311
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.E3-1 (A-67)	3.3.1-49	D
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Loss of material-wear	Service Water Integrity	--	--	H
Heater housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2-3 (AP-41)	3.3.1-59	A
Heater housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-5 (AP-39)	3.3.1-21	A, 302
Heater housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-1 (A-63)	3.3.1-48	D
Moisture separator housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Moisture separator housing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-21 (A-23)	3.3.1-71	E
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-17 (A-34)	3.3.1-2	C
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-21 (A-23)	3.3.1-71	E
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-2 (A-27)	3.3.1-18	E

Table 3.3.2-4: Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-20 (AP-30)	3.3.1-14	A, 302
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-23 (A-25)	3.3.1-47	B
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-20 (AP-30)	3.3.1-14	A, 302
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	C
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-23 (A-25)	3.3.1-47	B
Receiver	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Receiver	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-21 (A-23)	3.3.1-71	E

Table 3.3.2-4: Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (int)	None	None	--	--	G
Restriction orifice	Pressure boundary Flow control	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Restriction orifice	Pressure boundary Flow control	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-17 (AP-59)	3.3.1-33	A, 302
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Sight glass	Pressure boundary	Glass	Condensation (int)	None	None	--	--	G
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A

Table 3.3.2-4: Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Silencer	Pressure boundary	Fiberglass	Air – indoor (ext)	None	None	--	--	F
Silencer	Pressure boundary	Fiberglass	Air – indoor (int)	None	None	--	--	F
Standpipe	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Standpipe	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-23 (A-25)	3.3.1-47	B
Strainer	Filtration	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer	Filtration	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Strainer	Filtration	Stainless steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2-17 (AP-59)	3.3.1-33	A, 302
Strainer	Filtration	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-17 (AP-59)	3.3.1-33	A, 302
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E

Table 3.3.2-4: Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-20 (AP-30)	3.3.1-14	A, 302
Thermowell	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Thermowell	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2-12 (AP-43)	3.3.1-84	A
Thermowell	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-8 (AP-12)	3.3.1-51	B
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Thermowell	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Thermowell	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-17 (AP-59)	3.3.1-33	A, 302
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	D
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.D-4 (AP-81)	3.3.1-54	E
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-17 (AP-59)	3.3.1-33	A, 302
Turbocharger	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Turbocharger	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Turbocharger	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Turbocharger	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-2 (A-27)	3.3.1-18	E
Turbocharger	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-23 (A-25)	3.3.1-47	B

Table 3.3.2-4: Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Aluminum	Air – indoor (int)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-17 (A-34)	3.3.1-2	C
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-21 (A-23)	3.3.1-71	E
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-20 (AP-30)	3.3.1-14	A, 302
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-23 (A-25)	3.3.1-47	B
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Copper alloy	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-9 (AP-78)	3.3.1-28	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-9 (AP-78)	3.3.1-28	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (int)	Loss of material	Selective Leaching	--	--	H
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-10 (AP-47)	3.3.1-26	A, 302

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2-12 (AP-43)	3.3.1-84	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-8 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-20 (AP-30)	3.3.1-14	A, 302
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	C
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-23 (A-25)	3.3.1-47	B
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.D-4 (AP-81)	3.3.1-54	E

Table 3.3.2-4: Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Cracking	Oil Analysis	--	--	H
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-17 (AP-59)	3.3.1-33	A, 302
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Cooling Water	VII.C2-11 (AP-60)	3.3.1-46	D, 311
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	D

Table 3.3.2-5
Fuel Oil Systems
Summary of Aging Management Evaluation

Table 3.3.2-5: Fuel Oil Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I-1 (AP-28)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.H1-9 (A-01)	3.3.1-19	A
Bolting	Pressure boundary	Carbon steel	Soil (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-5: Fuel Oil Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Flame arrestor	Flow control	Aluminum	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Flame arrestor	Flow control	Aluminum	Air – outdoor (int)	Loss of material	External Surfaces Monitoring	--	--	G
Flame arrestor	Flow control	Gray cast iron	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H1-8 (A-24)	3.3.1-60	A
Flame arrestor	Flow control	Gray cast iron	Air – outdoor (int)	Loss of material	External Surfaces Monitoring	VIII.B1-6 (SP-59)	3.4.1-30	E
Flexible connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flexible connection	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-6 (AP-54)	3.3.1-32	B, 302
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H1-8 (A-24)	3.3.1-60	A

Table 3.3.2-5: Fuel Oil Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.H1-9 (A-01)	3.3.1-19	A
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Gray cast iron	Fuel oil (ext)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Pump casing	Pressure boundary	Gray cast iron	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Strainer	Filtration	Stainless steel	Fuel oil (ext)	Loss of material	Diesel Fuel Monitoring	VII.H1-6 (AP-54)	3.3.1-32	B, 302
Strainer	Filtration	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-6 (AP-54)	3.3.1-32	B, 302
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-5: Fuel Oil Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Tank	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.H1-9 (A-01)	3.3.1-19	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-3 (AP-44)	3.3.1-32	B, 302
Tubing	Pressure boundary	Copper alloy	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring Fire Protection	VII.G-10 (AP-44)	3.3.1-32	B, 312
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-6 (AP-54)	3.3.1-32	B, 302
Tubing	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring Fire Protection	VII.H1-6 (AP-54)	3.3.1-32	B, 312
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-5: Fuel Oil Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Valve body	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.H1-9 (A-01)	3.3.1-19	A
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-3 (AP-44)	3.3.1-32	B, 302
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-6 (AP-54)	3.3.1-32	B, 302

Table 3.3.2-6
Fire Protection—Water System
Summary of Aging Management Evaluation

Table 3.3.2-6: Fire Protection—Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I-1 (AP-28)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.G-25 (A-01)	3.3.1-19	C
Bolting	Pressure boundary	Carbon steel	Soil (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	--	--	G

Table 3.3.2-6: Fire Protection—Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Duct	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	C
Expansion joint	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Expansion joint	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Fire Protection	VII.H2-2 (A-27)	3.3.1-18	E
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Heater housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.G-5 (AP-41)	3.3.1-59	A
Heater housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	D, 304
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Instrument snubber	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Fire Water System	VII.G-19 (A-55)	3.3.1-69	B, 304
Muffler	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Muffler	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Muffler	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Fire Protection	VII.H2-2 (A-27)	3.3.1-18	E
Nozzle	Pressure boundary Flow control	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Nozzle	Pressure boundary Flow control	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Nozzle	Pressure boundary Flow control	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Nozzle	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	--	--	G
Nozzle	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
Nozzle	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Nozzle	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.G-13 (A-47)	3.3.1-84	A, 304
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Fire Protection	VII.H2-2 (A-27)	3.3.1-18	E
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.G-25 (A-01)	3.3.1-19	A
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Piping	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Gray cast iron	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Piping	Pressure boundary	Gray cast iron	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.G-25 (A-01)	3.3.1-19	A

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Gray cast iron	Soil (ext)	Loss of material	Selective Leaching	VII.G-15 (A-02)	3.3.1-85	A
Piping	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Piping	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.G-14 (A-51)	3.3.1-85	A, 304
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.G-14 (A-51)	3.3.1-85	A, 304
Restriction orifice	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Restriction orifice	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.G-13 (A-47)	3.3.1-84	A, 304
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Fire Water System	VII.G-19 (A-55)	3.3.1-69	B, 304
Retarding chamber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Retarding chamber	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Fire Water System	VII.G-19 (A-55)	3.3.1-69	B, 304
Strainer	Filtration	Carbon steel	Treated water (ext)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Strainer	Filtration	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Strainer	Filtration	Copper alloy	Treated water (ext)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Filtration	Copper alloy	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Strainer	Filtration	Copper alloy > 15% Zn or > 8% Al	Treated water (ext)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Strainer	Filtration	Copper alloy > 15% Zn or > 8% Al	Treated water (ext)	Loss of material	Selective Leaching	VII.G-13 (A-47)	3.3.1-84	A, 304
Strainer	Filtration	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Strainer	Filtration	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.G-13 (A-47)	3.3.1-84	A, 304
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Strainer housing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Strainer housing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.G-13 (A-47)	3.3.1-84	A, 304
Strainer housing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.G-14 (A-51)	3.3.1-85	A, 304
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Tank	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Aboveground Steel Tanks	VII.H1-11 (A-95)	3.3.1-40	C
Tank	Pressure boundary	Carbon steel	Concrete (ext)	Loss of material	Aboveground Steel Tanks	--	--	G

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Thermowell	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Tubing	Pressure boundary	Plastic	Air – indoor (ext)	None	None	--	--	F
Tubing	Pressure boundary	Plastic	Air – treated (int)	None	None	--	--	F
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Fire Water System	VII.G-19 (A-55)	3.3.1-69	B, 304
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Copper alloy	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.G-13 (A-47)	3.3.1-84	A, 304
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Gray cast iron	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Valve body	Pressure boundary	Gray cast iron	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.G-25 (A-01)	3.3.1-19	A
Valve body	Pressure boundary	Gray cast iron	Soil (ext)	Loss of material	Selective Leaching	VII.G-15 (A-02)	3.3.1-85	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.G-14 (A-51)	3.3.1-85	A, 304
Valve body	Pressure boundary	Plastic	Air – indoor (ext)	None	None	--	--	F
Valve body	Pressure boundary	Plastic	Air – treated (int)	None	None	--	--	F
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Fire Water System	VII.G-19 (A-55)	3.3.1-69	B, 304

Table 3.3.2-6: Fire Protection—Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Vortex breaker	Flow control	Carbon steel	Treated water (ext)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Vortex breaker	Flow control	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304

Table 3.3.2-7
Halon and CO_2 Systems
Summary of Aging Management Evaluation

Table 3.3.2-7: Halon and CO_2 Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.I-8 (A-77)	3.3.1-58	E
Accumulator	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Coil - heating or cooling	Pressure boundary	Copper alloy	Gas (ext)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Coil - heating or cooling	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	C
Flex hose	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-7: Halon and CO_2 Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flex hose	Pressure boundary	Teflon	Air – indoor (int)	None	None	--	--	F
Level gauge	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Level gauge	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Nozzle	Pressure boundary Flow control	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Nozzle	Pressure boundary Flow control	Aluminum	Air – indoor (int)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Nozzle	Pressure boundary Flow control	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.I-8 (A-77)	3.3.1-58	E
Nozzle	Pressure boundary Flow control	Carbon steel	Air – indoor (int)	Loss of material	Fire Protection	V.D2-16 (E-29)	3.2.1-32	E

Table 3.3.2-7: Halon and CO_2 Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.I-8 (A-77)	3.3.1-58	E
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Fire Protection	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.I-8 (A-77)	3.3.1-58	E
Tank	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G

Table 3.3.2-7: Halon and CO_2 Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.I-8 (A-77)	3.3.1-58	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Fire Protection	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	--	--	G

Table 3.3.2-7: Halon and CO_2 Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G

Table 3.3.2-8
Heating, Ventilation and Air Conditioning Systems
Summary of Aging Management Evaluation

Table 3.3.2-8: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I-1 (AP-28)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	--	--	G
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Damper housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Damper housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E

Table 3.3.2-8: Heating, Ventilation and Air Conditioning Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Damper housing	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Duct	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Duct	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Duct	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	Periodic Surveillance and Preventive Maintenance	VII.F1-7 (A-17)	3.3.1-11	E
Duct	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	Periodic Surveillance and Preventive Maintenance	VII.F1-7 (A-17)	3.3.1-11	E
Duct	Pressure boundary	Elastomer	Air – indoor (int)	Change in material properties	Periodic Surveillance and Preventive Maintenance	VII.F1-7 (A-17)	3.3.1-11	E

Table 3.3.2-8: Heating, Ventilation and Air Conditioning Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Duct	Pressure boundary	Elastomer	Air – indoor (int)	Cracking	Periodic Surveillance and Preventive Maintenance	VII.F1-7 (A-17)	3.3.1-11	E
Duct	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Duct	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Duct	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Duct flexible connection	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	Periodic Surveillance and Preventive Maintenance	VII.F1-7 (A-17)	3.3.1-11	E
Duct flexible connection	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	Periodic Surveillance and Preventive Maintenance	VII.F1-7 (A-17)	3.3.1-11	E
Duct flexible connection	Pressure boundary	Elastomer	Air – indoor (int)	Change in material properties	Periodic Surveillance and Preventive Maintenance	VII.F1-7 (A-17)	3.3.1-11	E

Table 3.3.2-8: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Duct flexible connection	Pressure boundary	Elastomer	Air – indoor (int)	Cracking	Periodic Surveillance and Preventive Maintenance	VII.F1-7 (A-17)	3.3.1-11	E
Fan housing	Pressure boundary	Aluminum	Air – indoor (int)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Fan housing	Pressure boundary	Aluminum	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.F1-2 (A-10)	3.3.1-56	C
Fan housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Fan housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.B-1 (E-25)	3.2.1-32	E
Fan housing	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A

Table 3.3.2-8: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Filter housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Filter housing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Heat exchanger (drain pan)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.F1-2 (A-10)	3.3.1-56	E
Heat exchanger (drain pan)	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.F1-3 (A-08)	3.3.1-72	E
Heat exchanger (fins)	Heat transfer	Aluminum	Air – indoor (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	--	--	H
Heat exchanger (fins)	Heat transfer	Copper alloy	Air – indoor (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	--	--	G

Table 3.3.2-8: Heating, Ventilation and Air Conditioning Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-10 (AP-41)	3.3.1-59	C
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Heat exchanger (pipe component)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.F1-2 (A-10)	3.3.1-56	E
Heat exchanger (pipe component)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.F1-11 (A-63)	3.3.1-48	D
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – indoor (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	--	--	G
Heat exchanger (tubes)	Heat transfer	Copper alloy	Treated water (int)	Fouling	Water Chemistry Control – Closed Cooling Water	VII.F1-12 (AP-80)	3.3.1-52	D
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-8: Heating, Ventilation and Air Conditioning Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.F1-8 (AP-34)	3.3.1-51	D
Louver housing	Pressure boundary	Aluminum	Air – indoor (int)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Louver housing	Pressure boundary	Aluminum	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Louver housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Louver housing	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Restriction orifice	Pressure boundary Flow control	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Restriction orifice	Pressure boundary Flow control	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-8: Heating, Ventilation and Air Conditioning Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G

Table 3.3.2-9
Fuel Pool Cooling and Cleanup System
Summary of Aging Management Evaluation

Table 3.3.2-9: Fuel Pool Cooling and Cleanup System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Panel	Neutron absorption	Aluminum/boron carbide	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	VII.A2-3 (A-89)	3.3.1-13	E
Panel	Neutron absorption	Aluminum/boron carbide	Treated water (ext)	Loss of material	Neutron Absorber Monitoring	VII.A2-3 (A-89)	3.3.1-13	E

Table 3.3.2-10
Instrument Air System
Summary of Aging Management Evaluation

Table 3.3.2-10: Instrument Air System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A
Accumulator	Pressure boundary	Carbon steel	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Accumulator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Accumulator	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Accumulator	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309

Table 3.3.2-10: Instrument Air System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Filter housing	Pressure boundary	Aluminum	Air – treated (int)	None	None	--	--	G
Filter housing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Filter housing	Pressure boundary	Copper alloy	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
Flexible connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flexible connection	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Lubricator	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Lubricator	Pressure boundary	Aluminum	Air – treated (int)	None	None	--	--	G
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A
Piping	Pressure boundary	Carbon steel	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	A

Table 3.3.2-10: Instrument Air System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.D-2 (A-26)	3.3.1-53	E
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Piping	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-10: Instrument Air System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Copper alloy	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
Tubing	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Aluminum	Air – treated (int)	None	None	--	--	G
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.D-2 (A-26)	3.3.1-53	E

Table 3.3.2-10: Instrument Air System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
Valve body	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A

Table 3.3.2-11
Reactor Equipment Cooling System
Summary of Aging Management Evaluation

Table 3.3.2-11: Reactor Equipment Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Flex hose	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flex hose	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Flow glass housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-11: Reactor Equipment Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flow glass housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-10 (AP-41)	3.3.1-59	C
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-5 (A-64)	3.3.1-77	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-10 (AP-41)	3.3.1-59	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-1 (A-63)	3.3.1-48	B
Heat exchanger (tubes)	Heat transfer	Stainless steel	Raw water (int)	Fouling	Service Water Integrity	VII.C1-7 (AP-61)	3.3.1-83	C

Table 3.3.2-11: Reactor Equipment Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water (ext)	Fouling	Water Chemistry Control – Closed Cooling Water	VII.C2-3. (AP-63)	3.3.1-52	B
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	C
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.E3-1 (A-67)	3.3.1-49	D
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material-wear	Service Water Integrity	--	--	H
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	A

Table 3.3.2-11: Reactor Equipment Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tank	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Thermowell	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B

Table 3.3.2-11: Reactor Equipment Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2-6 (AP-43)	3.3.1-84	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-11: Reactor Equipment Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B

Table 3.3.2-12
Plant Drains
Summary of Aging Management Evaluation

Table 3.3.2-12: Plant Drains								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I-1 (AP-28)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Bolting	Pressure boundary	Carbon steel	Raw water (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	--	--	G

Table 3.3.2-12: Plant Drains

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Hose	Pressure boundary	Plastic	Air – indoor (ext)	None	None	--	--	F
Hose	Pressure boundary	Plastic	Air – indoor (int)	None	None	--	--	F
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.C1-18 (A-01)	3.3.1-19	C

Table 3.3.2-12: Plant Drains								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary Flow control	Carbon steel	Raw water (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Piping	Pressure boundary Flow control	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Pump casing	Pressure boundary	Aluminum	Raw water (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-8 (AP-83)	3.3.1-62	E
Pump casing	Pressure boundary	Aluminum	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-8 (AP-83)	3.3.1-62	E
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.I-8 (A-77)	3.3.1-58	E
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2-16 (E-29)	3.2.1-32	E

Table 3.3.2-12: Plant Drains								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Gray cast iron	Raw water (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Pump casing	Pressure boundary	Gray cast iron	Raw water (ext)	Loss of material	Selective Leaching	VII.C1-11 (A-51)	3.3.1-85	C
Pump casing	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Pump casing	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Selective Leaching	VII.C1-11 (A-51)	3.3.1-85	C
Restriction orifice	Pressure boundary Flow control	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Restriction orifice	Pressure boundary Flow control	Stainless steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-15 (A-54)	3.3.1-79	E
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-12: Plant Drains

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-15 (A-54)	3.3.1-79	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Valve body	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G

Table 3.3.2-12: Plant Drains

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-9 (A-44)	3.3.1-81	E
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Selective Leaching	VII.C1-11 (A-51)	3.3.1-85	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-15 (A-54)	3.3.1-79	E

Table 3.3.2-13
Nitrogen System
Summary of Aging Management Evaluation

Table 3.3.2-13: Nitrogen System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Accumulator	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	--	--	G
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309

Table 3.3.2-13: Nitrogen System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.F1-1 (A-09)	3.3.1-27	E
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Coil	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Coil	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	C
Coil	Pressure boundary	Copper alloy	Liquid nitrogen (int)	None	None	--	--	G
Coil - heating or cooling	Heat transfer	Copper alloy	Raw water (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	VII.C1-6 (A-72)	3.3.1-83	E
Coil - heating or cooling	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	C
Coil - heating or cooling	Pressure boundary	Copper alloy	Liquid nitrogen (int)	None	None	--	--	G
Coil - heating or cooling	Pressure boundary	Copper alloy	Raw water (ext)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-9 (A-44)	3.3.1-81	E

Table 3.3.2-13: Nitrogen System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Filter housing	Pressure boundary	Aluminum	Air – indoor (int)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Flex hose	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flex hose	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-9 (A-78)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Piping	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Piping	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G

Table 3.3.2-13: Nitrogen System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Piping	Pressure boundary	Copper alloy	Liquid nitrogen (int)	None	None	--	--	G
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Piping	Pressure boundary	Stainless steel	Liquid nitrogen (int)	None	None	--	--	G
Rupture disc	Pressure boundary	Nickel alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Rupture disc	Pressure boundary	Nickel alloy	Gas (int)	None	None	--	--	G
Strainer	Filtration	Stainless steel	Liquid nitrogen (ext)	None	None	--	--	G
Strainer	Filtration	Stainless steel	Liquid nitrogen (int)	None	None	--	--	G
Strainer housing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Strainer housing	Pressure boundary	Copper alloy	Liquid nitrogen (int)	None	None	--	--	G

Table 3.3.2-13: Nitrogen System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Strainer housing	Pressure boundary	Stainless steel	Liquid nitrogen (int)	None	None	--	--	G
Tank	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H1-11 (A-95)	3.3.1-40	E
Tank	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Tank	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried Piping and Tanks Inspection	VII.C1-18 (A-01)	3.3.1-19	C
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tank	Pressure boundary	Stainless steel	Liquid nitrogen (int)	None	None	--	--	G
Tubing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Tubing	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Tubing	Pressure boundary	Copper alloy	Liquid nitrogen (int)	None	None	--	--	G

Table 3.3.2-13: Nitrogen System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Tubing	Pressure boundary	Stainless steel	Liquid nitrogen (int)	None	None	--	--	G
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G

Table 3.3.2-13: Nitrogen System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Valve body	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Valve body	Pressure boundary	Copper alloy	Liquid nitrogen (int)	None	None	--	--	G
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A

Table 3.3.2-13: Nitrogen System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Liquid nitrogen (int)	None	None	--	--	G
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Valve body	Pressure boundary	Stainless steel	Liquid nitrogen (int)	None	None	--	--	G

Table 3.3.2-14-1
Auxiliary Condensate Drains System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-1: Auxiliary Condensate Drains System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306

Table 3.3.2-14-1: Auxiliary Condensate Drains System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	C, 306
Strainer housing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Strainer housing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-4 (AP-12)	3.3.1-51	E, 306
Strainer housing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	C, 306
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Trap	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Trap	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-1: Auxiliary Condensate Drains System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Trap	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-4 (AP-12)	3.3.1-51	E, 306
Trap	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2-6 (AP-43)	3.3.1-84	C, 306
Trap	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Trap	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Trap	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	C, 306
Trap	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Trap	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-10 (A-52)	3.3.1-50	E, 306
Trap	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Auxiliary Systems	VII.C2-11 (AP-60)	3.3.1-46	E, 306
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-1: Auxiliary Condensate Drains System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-4 (AP-12)	3.3.1-51	E, 306
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-10 (A-52)	3.3.1-50	E, 306
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Auxiliary Systems	VII.C2-11 (AP-60)	3.3.1-46	E, 306
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-4 (AP-12)	3.3.1-51	E, 306

Table 3.3.2-14-1: Auxiliary Condensate Drains System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-4 (AP-12)	3.3.1-51	E, 306
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2-6 (AP-43)	3.3.1-84	C, 306
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-10 (A-52)	3.3.1-50	E, 306
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Auxiliary Systems	VII.C2-11 (AP-60)	3.3.1-46	E, 306

Table 3.3.2-14-2
Auxiliary Steam System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C, 305
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A-17 (S-15)	3.4.1-29	D

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C, 305
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D, 307
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Strainer housing	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C, 305
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C, 305
Strainer housing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Copper alloy	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	--	--	G
Strainer housing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-4 (AP-12)	3.3.1-51	E, 306
Strainer housing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Strainer housing	Pressure boundary	Gray cast iron	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C, 305
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C, 305
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	C, 306
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Trap	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Trap	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C, 305
Trap	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A-17 (S-15)	3.4.1-29	D
Trap	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Trap	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C, 305
Trap	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D, 307
Trap	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Trap	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Trap	Pressure boundary	Gray cast iron	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C, 305

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Trap	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A-17 (S-15)	3.4.1-29	D
Trap	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Trap	Pressure boundary	Gray cast iron	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C, 305
Trap	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	C, 306
Trap	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D, 307
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-13 (SP-46)	3.4.1-37	E, 310
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – Auxiliary Systems	VIII.A-11 (SP-45)	3.4.1-13	E, 310
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-10 (A-52)	3.3.1-50	E, 306
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Auxiliary Systems	VII.C2-11 (AP-60)	3.3.1-46	E, 306
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C, 305
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C, 305
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A-17 (S-15)	3.4.1-29	D
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C, 305

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D, 307
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	--	--	G
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-4 (AP-12)	3.3.1-51	E, 306
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Valve body	Pressure boundary	Gray cast iron	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C, 305
Valve body	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A-17 (S-15)	3.4.1-29	D
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C, 305
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	C, 306
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D, 307
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-13 (SP-46)	3.4.1-37	E, 310
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – Auxiliary Systems	VIII.A-11 (SP-45)	3.4.1-13	E, 310
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-10 (A-52)	3.3.1-50	E, 306
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Auxiliary Systems	VII.C2-11 (AP-60)	3.3.1-46	E, 306

Table 3.3.2-14-2: Auxiliary Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C, 305

Table 3.3.2-14-3
Control Rod Drive System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-3: Control Rod Drive System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-3: Control Rod Drive System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Flow indicator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow indicator	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Flow indicator	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-10 (AP-41)	3.3.1-59	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-5 (AP-39)	3.3.1-21	C, 302
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Instrument snubber	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301

Table 3.3.2-14-3: Control Rod Drive System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Instrument snubber	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301

Table 3.3.2-14-3: Control Rod Drive System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Restriction orifice	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Restriction orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E

Table 3.3.2-14-3: Control Rod Drive System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-9 (AP-64)	3.3.1-31	C, 301
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302

Table 3.3.2-14-3: Control Rod Drive System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E

Table 3.3.2-14-4
Demineralized Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-4: Demineralized Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Flow indicator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Flow indicator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A

Table 3.3.2-14-4: Demineralized Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-9 (AP-64)	3.3.1-31	C, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-4: Demineralized Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-9 (AP-64)	3.3.1-31	C, 301
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-9 (AP-64)	3.3.1-31	C, 301
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.E3-11 (AP-32)	3.3.1-84	C
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.E3-12 (AP-31)	3.3.1-85	C

Table 3.3.2-14-4: Demineralized Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301

Table 3.3.2-14-5
Diesel Generator Fuel Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-5: Diesel Generator Fuel Oil System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Sight glass	Pressure boundary	Glass	Fuel oil (int)	None	None	VII.J-9 (AP-49)	3.3.1-93	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-6 (AP-54)	3.3.1-32	B, 302

Table 3.3.2-14-5: Diesel Generator Fuel Oil System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1-10 (A-30)	3.3.1-20	B, 302

Table 3.3.2-14-6
Diesel Generator Jacket Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-6: Diesel Generator Jacket Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-23 (A-25)	3.3.1-47	B
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-8 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-6: Diesel Generator Jacket Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.H2-8 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2-12 (AP-43)	3.3.1-84	A

Table 3.3.2-14-7
Diesel Generator Starting Air System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-7: Diesel Generator Starting Air System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-21 (A-23)	3.3.1-71	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.H2-21 (A-23)	3.3.1-71	E
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-7: Diesel Generator Starting Air System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-9 (AP-78)	3.3.1-28	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-9 (AP-78)	3.3.1-28	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (int)	Loss of material	Selective Leaching	--	--	H

Table 3.3.2-14-8
Fire Protection System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-8: Fire Protection System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Accumulator	Pressure boundary	Carbon steel	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-8: Fire Protection System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Fire Water System	VII.G-19 (A-55)	3.3.1-69	B, 304
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Fire Water System	VII.G-19 (A-55)	3.3.1-69	B, 304
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-8: Fire Protection System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Fire Water System	VII.G-12 (A-45)	3.3.1-70	B, 304
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.G-13 (A-47)	3.3.1-84	A, 304
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Fire Water System	VII.G-24 (A-33)	3.3.1-68	B, 304
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.G-14 (A-51)	3.3.1-85	A, 304
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Fire Water System	VII.G-19 (A-55)	3.3.1-69	B, 304

Table 3.3.2-14-9
Floor Drains, Non-Radioactive System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-9: Non-Radioactive Floor Drain System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E

Table 3.3.2-14-9: Non-Radioactive Floor Drain System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-9 (A-44)	3.3.1-81	E
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E

Table 3.3.2-14-10
Fuel Pool Cooling and Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-10:Fuel Pool Cooling and Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Flow indicator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Flow indicator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-10 (AP-41)	3.3.1-59	C

Table 3.3.2-14-10:Fuel Pool Cooling and Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.A4-3 (A-63)	3.3.1-48	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-11 (A-58)	3.3.1-24	A, 301
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.A4-10 (AP-31)	3.3.1-85	A
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Restriction orifice	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301

Table 3.3.2-14-10:Fuel Pool Cooling and Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-11 (A-58)	3.3.1-24	A, 301
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-7 (AP-64)	3.3.1-31	A, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-11 (A-58)	3.3.1-24	A, 301

Table 3.3.2-14-10:Fuel Pool Cooling and Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-11 (A-58)	3.3.1-24	A, 301

Table 3.3.2-14-11
Heating and Ventilation System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-11:Heating and Ventilation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D-1 (A-103)	3.3.1-44	C
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.F1-1 (A-09)	3.3.1-27	E
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Coil	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-11:Heating and Ventilation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Coil	Pressure boundary	Copper alloy	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	--	--	G
Damper housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Damper housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Duct	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Fan housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B-1 (E-25)	3.2.1-32	E
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Flow element	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C

Table 3.3.2-14-11:Heating and Ventilation System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-10 (A-52)	3.3.1-50	E, 306
Pump casing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Pump casing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.F1-15 (AP-12)	3.3.1-51	E, 306
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Strainer housing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A

Table 3.3.2-14-11:Heating and Ventilation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Strainer housing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Strainer housing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Strainer housing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.F1-15 (AP-12)	3.3.1-51	E, 306
Strainer housing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Strainer housing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.F3-18 (A-50)	3.3.1-85	C, 306
Strainer housing	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Strainer housing	Pressure boundary	Gray cast iron	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C

Table 3.3.2-14-11:Heating and Ventilation System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Trap	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Trap	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Trap	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.F3-18 (A-50)	3.3.1-85	C, 306
Trap	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VIII.A-15 (S-04)	3.4.1-2	E, 303
Trap	Pressure boundary	Gray cast iron	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B1-10 (S-08)	3.4.1-1	C
Trap	Pressure boundary	Gray cast iron	Steam (int)	Loss of material	Selective Leaching	--	--	G
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.F1-15 (AP-12)	3.3.1-51	E, 306

Table 3.3.2-14-11:Heating and Ventilation System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-10 (A-52)	3.3.1-50	E, 306
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Steam (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	--	--	G

Table 3.3.2-14-11:Heating and Ventilation System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.F1-15 (AP-12)	3.3.1-51	E, 306
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.F1-15 (AP-12)	3.3.1-51	E, 306
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.F1-17 (AP-43)	3.3.1-84	C, 306
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-2 (A-10)	3.3.1-56	C
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-14 (A-25)	3.3.1-47	E, 306
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.F3-18 (A-50)	3.3.1-85	C, 306
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-11:Heating and Ventilation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Auxiliary Systems	VII.C2-10 (A-52)	3.3.1-50	E, 306

Table 3.3.2-14-12
Instrument Air System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-12:Instrument Air System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A
Accumulator	Pressure boundary	Carbon steel	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Accumulator	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Filter housing	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Filter housing	Pressure boundary	Aluminum	Air – treated (int)	None	None	--	--	G

Table 3.3.2-14-12:Instrument Air System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Aluminum	Gas (int)	None	None	VII.J-2 (AP-37)	3.3.1-97	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A
Filter housing	Pressure boundary	Carbon steel	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Filter housing	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Filter housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Filter housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Filter housing	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A

Table 3.3.2-14-12:Instrument Air System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Restriction orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Restriction orifice	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
Tubing	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A

Table 3.3.2-14-12:Instrument Air System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Aluminum	Air – treated (int)	None	None	--	--	G
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A
Valve body	Pressure boundary	Carbon steel	Air – treated (int)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
Valve body	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	A

Table 3.3.2-14-12:Instrument Air System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – treated (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A

Table 3.3.2-14-13
Nuclear Boiler Instrumentation System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-13:Nuclear Boiler Instrumentation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-13:Nuclear Boiler Instrumentation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-13:Nuclear Boiler Instrumentation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Gas (int)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.3.2-14-14
Off Gas System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-14:Off Gas System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Sight glass	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E

Table 3.3.2-14-14:Off Gas System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Sight glass	Pressure boundary	Glass	Raw water (int)	None	None	VII.J-11 (AP-50)	3.3.1-93	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Tank	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VII.C1-15 (A-54)	3.3.1-79	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-14:Off Gas System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VII.C1-15 (A-54)	3.3.1-79	E

Table 3.3.2-14-15
Optimum Water Chemistry System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-15: Optimum Water Chemistry System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-15: Optimum Water Chemistry System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301

Table 3.3.2-14-16
Post-Accident Sample System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-16:Post-Accident Sample System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	C
Heat exchanger (shell)	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4-2 (A-70)	3.3.1-23	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-16:Post-Accident Sample System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E

Table 3.3.2-14-17
Potable Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-17:Potable Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Piping	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Piping	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-24 (A-33)	3.3.1-68	E, 304
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-24 (A-33)	3.3.1-68	E, 304
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-17:Potable Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-24 (A-33)	3.3.1-68	E, 304

Table 3.3.2-14-18
Reactor Equipment Cooling System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-18:Reactor Equipment Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D-1 (A-103)	3.3.1-44	C
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.F1-1 (A-09)	3.3.1-27	E
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Deaerator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-18:Reactor Equipment Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Deaerator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Demineralizer	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Demineralizer	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Flow indicator	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Flow indicator	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	--	--	G

Table 3.3.2-14-18:Reactor Equipment Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Flow indicator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow indicator	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	C
Heat exchanger (shell)	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	D
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B

Table 3.3.2-14-18:Reactor Equipment Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Pump casing	Pressure boundary	Plastic	Air – indoor (ext)	None	None	--	--	F
Pump casing	Pressure boundary	Plastic	Treated water (int)	None	None	--	--	F
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Pump casing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Separator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Separator	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-18:Reactor Equipment Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Sight glass	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Thermowell	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E

Table 3.3.2-14-18:Reactor Equipment Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	--	--	G
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A

Table 3.3.2-14-18:Reactor Equipment Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2-6 (AP-43)	3.3.1-84	A
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B

Table 3.3.2-14-18:Reactor Equipment Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B

Table 3.3.2-14-19
Radiation Monitoring – Process System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-19:Radiation Monitoring – Process System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Flow indicator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow indicator	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	D
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-19:Radiation Monitoring – Process System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	D
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	D
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	D

Table 3.3.2-14-20
Radiation Monitoring – Ventilation System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-20:Radiation Monitoring – Ventilation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-20:Radiation Monitoring – Ventilation System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2-16 (E-29)	3.2.1-32	E
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	--	--	G

Table 3.3.2-14-21
Reactor Recirculation System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-21:Reactor Recirculation System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-21:Reactor Recirculation System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E4-15 (A-61)	3.3.1-38	E
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.3.2-14-22
Reactor Recirculation Lube Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-22: Reactor Recirculation Lube Oil System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	C
Heat exchanger (shell)	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-14 (AP-59)	3.3.1-33	C, 302

Table 3.3.2-14-22: Reactor Recirculation Lube Oil System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-14 (AP-59)	3.3.1-33	C, 302
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Restriction orifice	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-14 (AP-59)	3.3.1-33	C, 302

Table 3.3.2-14-22: Reactor Recirculation Lube Oil System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-10 (AP-47)	3.3.1-26	C, 302
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2-10 (AP-47)	3.3.1-26	C, 302
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-17 (AP-30)	3.3.1-14	C, 302
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-22: Reactor Recirculation Lube Oil System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1-14 (AP-59)	3.3.1-33	C, 302

Table 3.3.2-14-23
Radwaste System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-23:Radwaste System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D-1 (A-103)	3.3.1-44	C
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Eductor	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Eductor	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VII.C1-15 (A-54)	3.3.1-79	E
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-23:Radwaste System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flow element	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-10 (AP-41)	3.3.1-59	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-1 (A-63)	3.3.1-48	D
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VII.C1-15 (A-54)	3.3.1-79	E

Table 3.3.2-14-23:Radwaste System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Pump casing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VII.C1-15 (A-54)	3.3.1-79	E
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Restriction orifice	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Separator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Separator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Strainer housing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C

Table 3.3.2-14-23:Radwaste System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-9 (A-44)	3.3.1-81	E
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tank	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VII.C1-15 (A-54)	3.3.1-79	E
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-9 (A-44)	3.3.1-81	E
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VII.C1-15 (A-54)	3.3.1-79	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-23:Radwaste System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-19 (A-38)	3.3.1-76	E
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-9 (A-44)	3.3.1-81	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.C1-9 (A-44)	3.3.1-81	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Selective Leaching	VII.C1-10 (A-47)	3.3.1-84	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VII.C1-15 (A-54)	3.3.1-79	E

Table 3.3.2-14-24
Reactor Water Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-24: Reactor Water Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Demineralizer	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Demineralizer	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301
Eductor	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Eductor	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-24: Reactor Water Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3-16 (A-60)	3.3.1-37	E
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	A
Flow indicator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Flow indicator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301

Table 3.3.2-14-24: Reactor Water Cleanup System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1-10 (AP-41)	3.3.1-59	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.E3-4 (A-63)	3.3.1-48	B, 301
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Heat exchanger (shell)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Heat exchanger (shell)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3-19 (A-85)	3.3.1-5	E
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Instrument snubber	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301

Table 3.3.2-14-24: Reactor Water Cleanup System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3-16 (A-60)	3.3.1-37	E
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301
Restriction orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-24: Reactor Water Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3-16 (A-60)	3.3.1-37	E
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3-16 (A-60)	3.3.1-37	E

Table 3.3.2-14-24: Reactor Water Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3-16 (A-60)	3.3.1-37	E
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	A
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-7 (AP-38)	3.3.1-24	A, 301
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C

Table 3.3.2-14-24: Reactor Water Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-9 (AP-64)	3.3.1-31	A, 301
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.E3-11 (AP-32)	3.3.1-84	A
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	A, 301
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.E3-12 (AP-31)	3.3.1-85	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3-16 (A-60)	3.3.1-37	E

Table 3.3.2-14-24: Reactor Water Cleanup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	A, 301

Table 3.3.2-14-25
Service Air System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-25:Service Air System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.D-2 (A-26)	3.3.1-53	E
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-9 (AP-78)	3.3.1-28	E

Table 3.3.2-14-25:Service Air System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	One-Time Inspection	VII.D-4 (AP-81)	3.3.1-54	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D-3 (A-80)	3.3.1-57	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.D-2 (A-26)	3.3.1-53	E
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Condensation (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.G-9 (AP-78)	3.3.1-28	E
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	One-Time Inspection	VII.D-4 (AP-81)	3.3.1-54	E

Table 3.3.2-14-26
Service Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-26:Service Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D-1 (A-103)	3.3.1-44	C
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A, 309
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.F1-1 (A-09)	3.3.1-27	E
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Strainer housing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A

Table 3.3.2-14-26:Service Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Strainer housing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Thermowell	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Thermowell	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Tubing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Tubing	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-9 (A-44)	3.3.1-81	A
Tubing	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A

Table 3.3.2-14-26:Service Water System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Valve body	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-9 (A-44)	3.3.1-81	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-9 (A-44)	3.3.1-81	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Selective Leaching	VII.C1-10 (A-47)	3.3.1-84	A
Valve body	Pressure boundary	Gray cast iron	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I-11 (A-81)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-19 (A-38)	3.3.1-76	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Selective Leaching	VII.C1-11 (A-51)	3.3.1-85	A
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E

Table 3.3.2-14-26:Service Water System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1-15 (A-54)	3.3.1-79	A

Table 3.3.2-14-27
Standby Liquid Control System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-27:Standby Liquid Control System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.I-8 (AP-14)	3.3.1-93	A
Flow indicator	Pressure boundary	Glass	Sodium pentaborate solution (int)	None	None	--	--	G
Flow indicator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow indicator	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301

Table 3.3.2-14-27:Standby Liquid Control System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Piping	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Pump casing	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Strainer housing	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301

Table 3.3.2-14-27:Standby Liquid Control System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tank	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Tank	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-18 (A-35)	3.3.1-17	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-27:Standby Liquid Control System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2-1 (AP-73)	3.3.1-30	A, 301
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3-15 (A-58)	3.3.1-24	C, 301

Table 3.3.2-14-28
Standby Nitrogen Injection System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-28:Standby Nitrogen Injection System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Flow indicator	Pressure boundary	Glass	Gas (int)	None	None	--	--	G
Flow indicator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow indicator	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

Table 3.3.2-14-28:Standby Nitrogen Injection System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J-19 (AP-22)	3.3.1-97	A

Table 3.3.2-14-29
Turbine Equipment Cooling System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-14-29:Turbine Equipment Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I-5 (AP-26)	3.3.1-45	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 309
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Flexible connection	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Flexible connection	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B

Table 3.3.2-14-29:Turbine Equipment Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flow indicator	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Flow indicator	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Pump casing	Pressure boundary	Plastic	Air – indoor (ext)	None	None	--	--	F
Pump casing	Pressure boundary	Plastic	Treated water (int)	None	None	--	--	F
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-29:Turbine Equipment Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Sight glass	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tank	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B

Table 3.3.2-14-29:Turbine Equipment Cooling System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	--	--	G
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A

Table 3.3.2-14-29:Turbine Equipment Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-4 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2-6 (AP-43)	3.3.1-84	A
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I-8 (A-77)	3.3.1-58	A
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-14 (A-25)	3.3.1-47	B

Table 3.3.2-14-29:Turbine Equipment Cooling System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VII.C2-8 (A-50)	3.3.1-85	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Cooling Water	VII.C2-10 (A-52)	3.3.1-50	B

3.4 STEAM AND POWER CONVERSION SYSTEMS

3.4.1 Introduction

This section provides the results of the aging management reviews for components in the steam and power conversion systems that are subject to aging management review. The following systems are addressed in this section (the system descriptions are available in the referenced section).

- MSIV leakage pathway (Section 2.3.4.1)
- miscellaneous steam and power conversion systems in scope for 10 CFR 54.4(a)(2) (Section 2.3.4.2)

Table 3.4.1, Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the steam and power conversion system component group. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.4.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for the condensate storage system.

- Table 3.4.2-1 MSIV Leakage Pathway—Summary of Aging Management Evaluation

Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

- Table 3.4.2-2-1 Circulating Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.4.2-2-2 Condensate Drains, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.4.2-2-3 Condensate Filter Demineralizer System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.4.2-2-4 Condensate Makeup System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.4.2-2-5 Extraction Steam, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-6 Turbine-Generator Lube Oil – Mechanical, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-7 Turbine Lube Oil – Instruments, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-8 Main Condensate, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-9 Main Steam, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-10 Reactor Feedwater, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-11 Reactor Feedwater Pump and Turbine Lube Oil, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-12 Turbine Generator, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-13 Turbine Generator EH Fluid, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

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. Programs are described in Appendix B. Further details are provided in the system tables.

3.4.2.1.1 MSIV Leakage Pathway

Materials

MSIV leakage pathway components are constructed of the following materials.

- carbon steel
- copper alloy > 15% zinc or > 8% aluminum
- elastomer
- stainless steel

Environment

MSIV leakage pathway components are exposed to the following environments.

- air – indoor
- raw water
- steam
- treated water

Aging Effects Requiring Management

The following aging effects associated with the MSIV leakage pathway require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the MSIV leakage pathway components.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Water Chemistry Control – BWR

3.4.2.1.2 Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.4.2-2-xx tables.

Nonsafety-related components affecting safety-related systems are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- copper alloy > 15% zinc or > 8% aluminum
- glass
- gray cast iron
- stainless steel

Environment

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- air – indoor
- air – treated
- condensation
- lube oil
- raw water
- steam
- treated water
- treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- cracking
- cracking – fatigue
- loss of material
- loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – BWR

3.4.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 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 approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.4.2.2.1 Cumulative Fatigue Damage

Where identified as an aging effect requiring management, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). Evaluation of this TLAA is addressed in Section 4.3.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

1. Loss of material due to general, pitting and crevice corrosion for carbon steel piping and piping components and tanks exposed to treated water and for carbon steel piping and components exposed to steam is an aging effect requiring management in the steam and power conversion and other systems at CNS, which is managed by the Water Chemistry Control – BWR Program. For other systems with controlled water chemistry, the Water Chemistry Control – Auxiliary Systems Program manages loss of material for steel components exposed to steam. The effectiveness of these water chemistry control programs will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting these programs including susceptible locations such as areas of stagnant flow.

2. Loss of material due to general, pitting and crevice corrosion in steel piping and components exposed to lubricating oil is managed by the Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.4.2.2.3 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC), and Fouling

Loss of material due to general, pitting, crevice, and MIC, and fouling in steel piping and components in the steam and power conversion systems exposed to raw water is managed by the Periodic Surveillance and Preventive Maintenance Program. The program uses periodic visual inspections to manage loss of material of the components. These inspections will manage the aging effect of loss of material such that the intended function of the components will not be affected.

3.4.2.2.4 Reduction of Heat Transfer due to Fouling

1. Reduction of heat transfer due to fouling could occur for stainless steel and copper alloy heat exchanger tubes exposed to treated water. The steam and power conversion systems at CNS have no heat exchanger tubes with an intended function of heat transfer and associated aging effect of fouling.

However, reduction of heat transfer is managed by the Water Chemistry Control – BWR Program for copper alloy heat exchanger tubes in the high pressure coolant injection and reactor core isolation cooling systems. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

2. Reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The steam and power conversion systems at CNS have no heat exchanger tubes with an intended function of heat transfer and associated aging effect of fouling. However, the reduction of heat transfer due to fouling for stainless steel and copper alloy heat exchanger tubes exposed to lubricating oil in the diesel generator system is managed by the Oil Analysis Program. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to fouling. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.4.2.2.5 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

1. Loss of material due to general, pitting, and crevice corrosion and MIC could occur in carbon steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to soil. The steam and power conversion systems at CNS have no carbon steel components that are exposed to soil. This item was not used.

2. Loss of material due to general, pitting, crevice corrosion and MIC for carbon steel heat exchanger components exposed to lubricating oil is an aging effect requiring management in the steam and power conversion systems at CNS and is managed by the Oil Analysis Program. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.4.2.2.6 Cracking due to Stress Corrosion Cracking (SCC)

Cracking due to SCC in stainless steel components exposed to steam or treated water > 140°F is managed by the Water Chemistry Control – BWR Program. For other systems with controlled water chemistry, the Water Chemistry Control – Auxiliary Systems Program manages cracking for stainless steel components exposed to steam. The effectiveness of these water chemistry control programs will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting these programs including susceptible locations such as areas of stagnant flow.

3.4.2.2.7 Loss of Material due to Pitting and Crevice Corrosion

1. Loss of material due to pitting and crevice corrosion for aluminum, copper alloy and stainless steel components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

2. Loss of material from pitting and crevice corrosion could occur in stainless steel piping and piping components exposed to a soil environment. The steam and power conversion systems at CNS have no stainless steel components that are exposed to soil. This item was not used.

3. Loss of material due to pitting and crevice corrosion for copper alloy piping and components exposed to lubricating oil is managed by the Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.4.2.2.8 Loss of Material due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

Loss of material due to pitting, crevice, and MIC in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil is managed by the Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.4.2.2.9 Loss of Material due to General, Pitting, Crevice, and Galvanic Corrosion

Loss of material due to general, pitting, crevice, and galvanic corrosion for steel heat exchanger components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of CNS quality assurance procedures and administrative controls for aging management programs.

3.4.2.3 Time-Limited Aging Analysis

The only time-limited aging analysis identified for the steam and power conversion systems components is metal fatigue. This is evaluated in Section 4.3.

3.4.3 Conclusion

The steam and power conversion system 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 the effects of aging on steam and power conversion system components are identified in Section 3.4.2.1 and in the following tables. 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 demonstrations provided in Appendix B, the effects of aging associated with the steam and power conversion system components 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 3.4.1
Summary of Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
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	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA. See Section 3.4.2.2.1.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-2	Steel piping, piping components, and piping elements exposed to steam	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 for components exposed to steam from treated water sources. Loss of material in steel components exposed to steam is managed by the Water Chemistry Control – BWR Program. For other systems with controlled water chemistry, the Water Chemistry Control – Auxiliary Systems Program manages loss of material for steel components exposed to steam. The One-Time Inspection Program will be used to verify the effectiveness of these water chemistry programs. This line applies to components in the ESF systems listed in Tables 3.2.2-x and to components in scope under criterion 10 CFR 54.4(a)(2) listed in series 3.2.2-8-xx, 3.3.2-14-xx and 3.4.2-2-xx tables. See Section 3.4.2.2.2 item 1.
3.4.1-3	PWR only				

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-4	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in steel components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.2 Item 1.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-5	Steel heat exchanger components exposed to treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in steel heat exchanger components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.9.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-6	Steel and stainless steel tanks exposed to treated water	Loss of material due to general (steel only) pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in steel tanks exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. There are no stainless steel tanks exposed to treated water in the steam and power conversion systems. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.2 item 1 and Section 3.4.2.2.7 item 1.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-7	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages loss of material in steel components exposed to lubricating oil. The One-Time Inspection Program will be used to verify the effectiveness of the Oil Analysis Program. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.2 item 2.
3.4.1-8	Steel piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Plant specific	Yes, plant specific	The Periodic Surveillance and Preventive Maintenance Program manages loss of material in steel components exposed to raw water. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.3.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-9	Stainless steel and copper alloy heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The reduction of heat transfer in copper alloy heat exchanger tubes exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are in the ESF systems in Tables 3.2.2-x. There are no stainless steel heat exchanger tubes exposed to treated water in the steam and power conversion systems. See Section 3.4.2.2.4 item 1.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-10	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Oil Analysis Program manages reduction of heat transfer in stainless steel and copper alloy heat exchanger tubes. The One-Time Inspection Program will be used to verify the effectiveness of the oil analysis program. The components to which this NUREG-1801 line item applies are in the diesel generator system in Table 3.3.2-4. There are no steel, stainless steel or copper alloy heat exchanger tubes exposed to lubricating oil with intended functions in the steam and power conversion systems. See Section 3.4.2.2.4 item 2.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-11	Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	This item was not used. There are no steel components exposed to soil in the steam and power conversion systems. See Section 3.4.2.2.5 item 1.
3.4.1-12	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in steel heat exchanger components exposed to lubricating oil is managed by the Oil Analysis Program. The One-Time Inspection Program will be used to verify the effectiveness of the oil analysis program. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.5 item 2.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-13	Stainless steel piping, piping components, piping elements exposed to steam	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 for components exposed to steam from treated water sources. Cracking in stainless steel components exposed to steam is managed by the Water Chemistry Control – BWR Program. For other systems with controlled water chemistry, the Water Chemistry Control – Auxiliary Systems Program manages cracking for stainless steel components exposed to steam. The One-Time Inspection Program will be used to verify the effectiveness of these water chemistry programs. See Section 3.4.2.2.6.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-14	Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Cracking in stainless steel components exposed to treated water > 140°F is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are in scope under criterion 10 CFR 54.4(a)(2) and are listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.6.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-15	Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in aluminum and copper alloy components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are in scope under criterion 10 CFR 54.4(a)(2) and are listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.7 item 1.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-16	Stainless steel piping, piping components, and piping elements; tanks, and heat exchanger components exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in stainless steel components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will be used to verify the effectiveness of the water chemistry program. The components to which this NUREG-1801 line item applies are in scope under criterion 10 CFR 54.4(a)(2) and are listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.7 item 1.
3.4.1-17	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	Plant specific	Yes, plant specific	This item was not used. There are no stainless steel components exposed to soil in the steam and power conversion systems. See Section 3.4.2.2.7 item 2.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-18	Copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in copper alloy components exposed to lubricating oil is managed by the Oil Analysis Program. The One-Time Inspection Program will be used to verify the effectiveness of the oil analysis program. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.7 item 3.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-19	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Loss of material in stainless steel components exposed to lubricating oil is managed by the Oil Analysis Program. The One-Time Inspection Program will be used to verify the effectiveness of the oil analysis program. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables. See Section 3.4.2.2.8.
3.4.1-20	Steel tanks exposed to air – outdoor (external)	Loss of material/ general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	This item was not used. There are no steel tanks exposed to outdoor air with intended functions in the steam and power conversion systems.
3.4.1-21	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	This item was not used. High-strength steel closure bolting is not used in the steam and power conversion systems.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-22	Steel bolting and closure bolting exposed to air with steam or water leakage, air – outdoor (external), or air – indoor uncontrolled (external);	Loss of material due to general, pitting and crevice corrosion; loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Consistent with NUREG-1801. The Bolting Integrity Program manages the loss of material for steel bolting. Loss of preload is a design-driven effect and not an aging effect requiring management. Bolting at CNS is standard grade B7 low alloy steel, or similar material, except in rare specialized applications such as where stainless steel bolting is utilized. Loss of preload due to stress relaxation (creep) would only be a concern in very high temperature applications (> 700°F), as stated in the ASME Code, Section II, Part D, Table 4. No CNS bolting operates at > 700°F. Therefore, loss of preload due to stress relaxation (creep) is not an applicable aging effect for steam and power conversion systems. Other issues such as gasket creep and self-loosening that may result in pressure boundary joint leakage are improper design or maintenance issues. (continued)

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
					Improper bolting application (design) and maintenance issues are current plant operational concerns and not related to aging effects or mechanisms that require management during the period of extended operation. Nevertheless, the Bolting Integrity Program manages loss of preload for all bolting in the steam and power conversion systems. As described in the Bolting Integrity Program, CNS has taken actions to address NUREG–1339, *Resolution to Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*. These actions include implementation of good bolting practices in accordance with EPRI NP-5067, Good Bolting Practices. Proper joint preparation and make-up in accordance with industry standards is expected to preclude loss of preload. This has been confirmed by operating experience at CNS.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
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	Closed-Cycle Cooling Water System	No	This item was not used. There are no stainless steel components exposed to closed cycle cooling water in the steam and power conversion systems.
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	Closed-Cycle Cooling Water System	No	This item was not used. There are no steel heat exchanger components exposed to closed cycle cooling water in the steam and power conversion systems.
3.4.1-25	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	This item was not used. There are no stainless steel components exposed to closed cycle cooling water in the steam and power conversion systems.
3.4.1-26	Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	This item was not used. There are no copper alloy components exposed to closed cycle cooling water in the steam and power conversion systems.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-27	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	This item was not used. There are no heat exchanger tubes exposed to closed cycle cooling water in the steam and power conversion systems.
3.4.1-28	Steel external surfaces exposed to air – indoor uncontrolled (external), condensation (external), or air outdoor (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring Program manages the loss of material for external surfaces of steel components.
3.4.1-29	Steel piping, piping components, and piping elements exposed to steam or treated water	Wall thinning due to Flow-Accelerated Corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801. The Flow-Accelerated Corrosion Program manages loss of material in steel components exposed to steam or treated water.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-30	Steel piping, piping components, and piping elements exposed to air outdoor (internal) or condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	The loss of material from the internal surfaces of steel components exposed to air – outdoor is managed by the External Surfaces Monitoring Program. The External Surfaces Monitoring Program manages loss of material for external carbon steel components by visual inspection of external surfaces. For systems where internal carbon steel surfaces are exposed to the same environment as external surfaces, external surface conditions will be representative of internal surfaces. Thus, loss of material on internal carbon steel surfaces is also managed by the External Surfaces Monitoring Program. The components to which this NUREG-1801 line item applies are in the ESF and auxiliary systems in Tables 3.2.2-x and 3.3.2-x. There are no steel components internally exposed to outdoor air or condensation in the steam and power conversion systems.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-31	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	This item was not used. There are no steel heat exchanger components exposed to raw water with intended functions in the steam and power conversion systems.
3.4.1-32	Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	The Periodic Surveillance and Preventive Maintenance Program manages loss of material for copper alloy components exposed to raw water through periodic visual inspections. The One-Time Inspection Program will confirm the absence of significant loss of material for stainless steel components exposed to raw water through visual inspections or other NDE techniques. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-33	Stainless steel heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	This item was not used. There are no stainless steel heat exchanger components exposed to raw water in the steam and power conversion systems.
3.4.1-34	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	This item was not used. There are no heat exchanger tubes exposed to raw water with an intended function of heat transfer in the steam and power conversion systems.
3.4.1-35	Copper alloy > 15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Selective Leaching of Materials	No	This item was not used. There are no copper alloy > 15% zinc or > 8% aluminum components exposed to water with an intended function of pressure boundary in the steam and power conversion systems.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-36	Gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. The Selective Leaching Program will manage loss of material in gray cast iron components exposed to raw or treated water. There are no gray cast iron components exposed to soil with intended functions in the steam and power conversion systems. The components to which this NUREG-1801 line item applies are included in scope under criterion 10 CFR 54.4(a)(2) and listed in series 3.4.2-2-xx tables.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-37	Steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Consistent with NUREG-1801 for components exposed to steam from treated water sources. Loss of material in steel and stainless steel components exposed to steam is managed by the Water Chemistry Control – BWR Program. For other systems with controlled water chemistry, the Water Chemistry Control – Auxiliary Systems Program manages loss of material for steel and stainless steel components exposed to steam. The One-Time Inspection Program will be used to verify the effectiveness of these water chemistry programs.
3.4.1-38	PWR only				
3.4.1-39	PWR only				
3.4.1-40	Glass piping elements exposed to air, lubricating oil, raw water, and treated water	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. The components to which this NUREG-1801 line item applies are in scope under criterion 10 CFR 54.4(a)(2) and are listed in series 3.4.2-2-xx tables.

Table 3.4.1: Steam and Power Conversion Systems, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-41	Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for stainless steel and copper alloy components. There are no nickel alloy components exposed to air in the steam and power conversion systems.
3.4.1-42	Steel piping, piping components, and piping elements exposed to air – indoor controlled (external)	None	None	NA - No AEM or AMP	This item was not used. There are no steel components exposed to air – indoor controlled in the steam and power conversion systems. All indoor air environments are conservatively considered to be uncontrolled.
3.4.1-43	Steel and stainless steel piping, piping components, and piping elements in concrete	None	None	NA - No AEM or AMP	This item was not used. There are no (mechanical) steel or stainless steel components exposed to concrete in the steam and power conversion systems.
3.4.1-44	Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA - No AEM or AMP	This item was not used. There are no steel, stainless steel, aluminum, or copper alloy components exposed to gas in the steam and power conversion systems.

Notes for Table 3.4.2-1 through 3.4.2-2-13

Generic Notes

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program 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 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

401. Aging management of the main condenser is not based on analysis of materials, environments and aging effects. Condenser integrity required to perform the post-accident intended function (holdup and plateout of MSIV leakage) is continuously confirmed by normal plant operation. This intended function does not require the condenser to be leak-tight, and the post accident conditions in the condenser will be essentially atmospheric. Since normal plant operation assures adequate condenser pressure boundary integrity, the post-accident intended function to provide holdup volume and plateout surface is assured. Based on past precedence (NUREG-1856, Brunswick SER, Section 3.4.2.1.5, and NUREG-1891, Pilgrim SER, Section 3.4.2.3), the staff concluded that main condenser integrity is continually verified during normal plant operation and no aging management program is required to assure the post-accident intended function.

402. The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program.

403. High component surface temperature precludes moisture accumulation that could result in corrosion.

404. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

405. Since loss of preload is not significantly dependent on environment, the environment given in this line is considered equivalent to the NUREG-1801 defined environments of air with reactor coolant leakage or air indoor uncontrolled for the evaluation of this aging effect.

**Table 3.4.2-1
MSIV Leakage Pathway
Summary of Aging Management Evaluation**

Table 3.4.2-1: MSIV Leakage Pathway								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Condenser	Plateout	Carbon steel	Air – indoor (ext)	None	None	--	--	401
Condenser	Plateout	Carbon steel	Steam (int)	None	None	--	--	401
Condenser	Plateout	Carbon steel	Treated water (int)	None	None	--	--	401
Condenser	Plateout	Copper alloy > 15% zinc or > 8% Al	Raw water (ext)	None	None	--	--	401
Condenser	Plateout	Copper alloy > 15% zinc or > 8% Al	Steam (int)	None	None	--	--	401
Condenser	Plateout	Stainless steel	Raw water (int)	None	None	--	--	401
Condenser	Plateout	Stainless steel	Steam (ext)	None	None	--	--	401

Table 3.4.2-1: MSIV Leakage Pathway

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Condenser	Plateout	Stainless steel	Treated water (ext)	None	None	--	--	401
Expansion joint	Plateout	Elastomer	Air – indoor (ext)	None	None	--	--	401
Expansion joint	Plateout	Elastomer	Steam (int)	None	None	--	--	401
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Flow element	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Flow element	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Flow element	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	VIII.H-7 (S-29)	3.4.1-28	I, 403
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A

Table 3.4.2-1: MSIV Leakage Pathway

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2-4 (S-15)	3.4.1-29	B
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Piping	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	VIII.H-7 (S-29)	3.4.1-28	I, 403
Restriction orifice	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Restriction orifice	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	VIII.H-7 (S-29)	3.4.1-28	I, 403

Table 3.4.2-1: MSIV Leakage Pathway

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer housing	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Strainer housing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	VIII.H-7 (S-29)	3.4.1-28	I, 403
Thermowell	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Thermowell	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	VIII.H-7 (S-29)	3.4.1-28	I, 403

Table 3.4.2-1: MSIV Leakage Pathway

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Trap	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Trap	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	VIII.H-7 (S-29)	3.4.1-28	I, 403
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2-4 (S-15)	3.4.1-29	B
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A

Table 3.4.2-1: MSIV Leakage Pathway

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A

Table 3.4.2-2-1
Circulating Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-1: Circulating Water System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D-1 (A-103)	3.3.1-44	C
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A, 405
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	--	--	G
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VIII.H-10 (S-42)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VIII.G-36 (S-12)	3.4.1-8	E
Tubing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-16 (A-46)	3.3.1-25	E

Table 3.4.2-2-1: Circulating Water System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VIII.A-4 (SP-31)	3.4.1-32	E
Tubing	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1-1 (A-09)	3.3.1-27	E
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	One-Time Inspection	VIII.E-27 (SP-36)	3.4.1-32	E
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VIII.H-10 (S-42)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VIII.G-36 (S-12)	3.4.1-8	E
Valve body	Pressure boundary	Gray cast iron	Condensation (ext)	Loss of material	External Surfaces Monitoring	VIII.H-10 (S-42)	3.4.1-28	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VIII.G-36 (S-12)	3.4.1-8	E
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Selective Leaching	VIII.A-7 (SP-28)	3.4.1-36	C

Table 3.4.2-2-2
Condensate Drains System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-2: Condensate Drains System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 402
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2-4 (S-15)	3.4.1-29	D
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402

Table 3.4.2-2-2: Condensate Drains System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.E-35 (S-16)	3.4.1-29	B
Restriction orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VIII.I-5 (SP-9)	3.4.1-40	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VIII.I-8 (SP-35)	3.4.1-40	A
Sight glass	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Sight glass	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Sight glass	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402

Table 3.4.2-2-2: Condensate Drains System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Trap	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Trap	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Trap	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402

Table 3.4.2-2-2: Condensate Drains System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Trap	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 402

Table 3.4.2-2-2: Condensate Drains System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2-4 (S-15)	3.4.1-29	D
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.E-35 (S-16)	3.4.1-29	B
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402

Table 3.4.2-2-2: Condensate Drains System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.4.2-2-3
Condensate Filter Demineralizer System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-3: Condensate Filter Demineralizer System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.E-35 (S-16)	3.4.1-29	B
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-5 (SP-61)	3.4.1-15	C, 402

Table 3.4.2-2-3: Condensate Filter Demineralizer System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.E-35 (S-16)	3.4.1-29	B
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402

Table 3.4.2-2-4
Condensate Makeup System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-4: Condensate Makeup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Flow indicator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Flow indicator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VIII.I-4 (SP-33)	3.4.1-40	A
Flow indicator	Pressure boundary	Glass	Treated water (int)	None	None	VIII.I-8 (SP-35)	3.4.1-40	A
Instrument snubber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A

Table 3.4.2-2-4: Condensate Makeup System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Instrument snubber	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Pump casing	Pressure boundary	Gray cast iron	Treated water (int)	Loss of material	Selective Leaching	VIII.E-23 (SP-27)	3.4.1-36	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-5 (SP-61)	3.4.1-15	C, 402
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402

Table 3.4.2-2-4: Condensate Makeup System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-15 (SP-24)	3.4.1-15	A, 402
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-5 (SP-61)	3.4.1-15	C, 402
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402

**Table 3.4.2-2-5
Extraction Steam System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation**

Table 3.4.2-2-5: Extraction Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Expansion joint	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Expansion joint	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Expansion joint	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402
Expansion joint	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	A, 402
Expansion joint	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402

Table 3.4.2-2-5: Extraction Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-3 (S-04)	3.4.1-2	A, 402
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.C-5 (S-15)	3.4.1-29	B
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-6 (S-09)	3.4.1-4	A, 402
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Piping	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402

Table 3.4.2-2-5: Extraction Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	A, 402
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Restriction orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Restriction orifice	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Restriction orifice	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402
Restriction orifice	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	A, 402
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402

Table 3.4.2-2-5: Extraction Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	A, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C

Table 3.4.2-2-5: Extraction Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	A, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F-2 (EP-3)	3.2.1-50	C
Valve body	Pressure boundary	Aluminum	Steam (int)	Loss of material	Water Chemistry Control – BWR	--	--	G
Valve body	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2-1 (SP-24)	3.4.1-15	C, 402
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-3 (S-04)	3.4.1-2	A, 402

Table 3.4.2-2-5: Extraction Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.C-5 (S-15)	3.4.1-29	B
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-6 (S-09)	3.4.1-4	A, 402
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	C
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	C, 402
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	A, 402

Table 3.4.2-2-5: Extraction Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.4.2-2-6
Turbine Generator Lube Oil – Mechanical System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-6: Turbine Generator Lube Oil – Mechanical System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Demister	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Demister	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Fan housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A

Table 3.4.2-2-6: Turbine Generator Lube Oil – Mechanical System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Flexible connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Flexible connection	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404
Flow indicator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Flow indicator	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Flow indicator	Pressure boundary	Glass	Air – indoor (ext)	None	None	VIII.I-4 (SP-33)	3.4.1-40	A
Flow indicator	Pressure boundary	Glass	Lube oil (int)	None	None	VIII.I-6 (SP-10)	3.4.1-40	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.G-6 (S-17)	3.4.1-12	C, 404

Table 3.4.2-2-6: Turbine Generator Lube Oil – Mechanical System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Pump casing	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Pump casing	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Restriction orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Restriction orifice	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404
Separator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Separator	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404

Table 3.4.2-2-6: Turbine Generator Lube Oil – Mechanical System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VIII.I-4 (SP-33)	3.4.1-40	A
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	VIII.I-6 (SP-10)	3.4.1-40	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Strainer housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Tubing	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-3 (SP-32)	3.4.1-18	C, 404
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404

Table 3.4.2-2-6: Turbine Generator Lube Oil – Mechanical System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Valve body	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-3 (SP-32)	3.4.1-18	C, 404
Valve body	Pressure boundary	Gray cast iron	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Gray cast iron	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404

Table 3.4.2-2-7
Turbine Generator Lube Oil – Instruments System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-7: Turbine Generator Lube Oil – Instruments System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Restriction orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Restriction orifice	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A

Table 3.4.2-2-7: Turbine Generator Lube Oil – Instruments System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-3 (SP-32)	3.4.1-18	C, 404
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	C, 404
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404

Table 3.4.2-2-8
Main Condensate System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-8: Main Condensate System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A

Table 3.4.2-2-8: Main Condensate System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-7 (S-18)	3.4.1-5	A, 402
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.E-35 (S-16)	3.4.1-29	B
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.E-32 (SP-25)	3.4.1-7	A, 404
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-40 (S-13)	3.4.1-6	A, 402
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (S-12)	3.4.1-41	A
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402

Table 3.4.2-2-8: Main Condensate System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-5 (SP-61)	3.4.1-15	C, 402
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-33 (S-09)	3.4.1-4	A, 402

Table 3.4.2-2-8: Main Condensate System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.E-35 (S-16)	3.4.1-29	B
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.E-32 (SP-25)	3.4.1-7	A, 404
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-5 (SP-61)	3.4.1-15	C, 402
Valve body	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VIII.E-17 (SP-32)	3.4.1-18	A, 404
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E-29 (SP-16)	3.4.1-16	A, 402
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	A, 402
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.4.2-2-8: Main Condensate System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.E-26 (SP-38)	3.4.1-19	A, 404

Table 3.4.2-2-9
Main Steam System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-9: Main Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Flow element	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Flow element	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Moisture separator (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A

Table 3.4.2-2-9: Main Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Moisture separator (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Moisture separator (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-6 (S-09)	3.4.1-4	A, 402
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2-4 (S-15)	3.4.1-29	B
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-6 (S-09)	3.4.1-4	A, 402
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D

Table 3.4.2-2-9: Main Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Restriction orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Restriction orifice	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A
Restriction orifice	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Restriction orifice	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	C, 402
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Restriction orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Rupture disk	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Rupture disk	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Rupture disk	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A

Table 3.4.2-2-9: Main Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Strainer housing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Strainer housing	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J-18 (AP-20)	3.3.1-98	C
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A

Table 3.4.2-2-9: Main Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	C, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-3 (S-05)	3.4.1-37	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2-4 (S-15)	3.4.1-29	B
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-6 (S-09)	3.4.1-4	A, 402

Table 3.4.2-2-9: Main Steam System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	D
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – treated (int)	None	None	VII.J-3 (AP-8)	3.3.1-98	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Steam (int)	Loss of material	Water Chemistry Control – BWR	--	--	G
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-2 (SP-46)	3.4.1-37	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2-1 (SP-45)	3.4.1-13	A, 402
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H

Table 3.4.2-2-9: Main Steam System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	C, 402
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.4.2-2-10
Reactor Feedwater System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-10: Reactor Feedwater System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2-7 (S-09)	3.4.1-4	A, 402
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	B
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 402

Table 3.4.2-2-10: Reactor Feedwater System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.B2-4 (S-15)	3.4.1-29	D
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2-4 (SP-16)	3.4.1-16	A, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2-4 (SP-16)	3.4.1-16	A, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.4.2-2-10: Reactor Feedwater System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2-7 (S-09)	3.4.1-4	A, 402
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2-8 (S-16)	3.4.1-29	B
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	C, 402
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VII.B2-4 (S-15)	3.4.1-29	D
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2-4 (SP-16)	3.4.1-16	A, 402
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402

Table 3.4.2-2-10: Reactor Feedwater System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C

Table 3.4.2-2-11
Reactor Feedwater Pump and Turbine Lube Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-11: Reactor Feedwater Pump and Turbine Lube Oil System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2-5 (SP-25)	3.4.1-7	A, 404
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Piping	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A

Table 3.4.2-2-11: Reactor Feedwater Pump and Turbine Lube Oil System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	C, 404

Table 3.4.2-2-12
Turbine Generator System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-12: Turbine Generator System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	A, 404
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	A, 402
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-6 (S-09)	3.4.1-4	C, 402

Table 3.4.2-2-12: Turbine Generator System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Thermowell	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	A, 404
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	C, 402
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	A, 402
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A

Table 3.4.2-2-12: Turbine Generator System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	A, 404
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E-31 (SP-19)	3.4.1-14	C, 402
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3-14 (A-62)	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.C-1 (SP-16)	3.4.1-16	C, 402
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A-11 (SP-45)	3.4.1-13	A, 402
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-13 (SP-46)	3.4.1-37	A
Turbine casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Turbine casing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	A, 402
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A

Table 3.4.2-2-12: Turbine Generator System [10 CFR 54.4(a)(2)]								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	A, 404
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2-6 (S-09)	3.4.1-4	C, 402
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2-5 (S-08)	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A-15 (S-04)	3.4.1-2	A, 402
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-3 (SP-32)	3.4.1-18	A, 404
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	A, 404

Table 3.4.2-2-13
Turbine Generator EH Fluid System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-2-13: Turbine Generator EH Fluid System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Accumulator	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	A, 404
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H-4 (S-34)	3.4.1-22	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H-5 (S-33)	3.4.1-22	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C2-8 (R-12)	3.1.1-52	C, 405
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	A, 404
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	C

Table 3.4.2-2-13: Turbine Generator EH Fluid System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (shell)	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.G-3 (S-20)	3.4.1-19	A, 404
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	A, 404
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	A, 404
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Strainer housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	A, 404
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Tank	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	A, 404
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A

Table 3.4.2-2-13: Turbine Generator EH Fluid System [10 CFR 54.4(a)(2)]

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-3 (SP-32)	3.4.1-18	A, 404
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H-7 (S-29)	3.4.1-28	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-14 (SP-25)	3.4.1-7	A, 404
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Valve body	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-3 (SP-32)	3.4.1-18	A, 404
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-3 (SP-32)	3.4.1-18	A, 404
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A-9 (SP-38)	3.4.1-19	A, 404

3.5 STRUCTURES AND COMPONENT SUPPORTS

3.5.1 Introduction

This section provides the results of the aging management review for structural components and commodities that are subject to aging management review. The following structures and commodity groups are addressed in this section (descriptions are available in the referenced sections).

- reactor building and primary containment (Section 2.4.1)
- water control structures (Section 2.4.2)
- turbine building, process facilities, and yard structures (Section 2.4.3)
- bulk commodities (Section 2.4.4)

Table 3.5.1, Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for structures and component supports. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.5.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for structures and component supports.

- Table 3.5.2-1 Reactor Building and Primary Containment—Summary of Aging Management Evaluation
- Table 3.5.2-2 Water Control Structures—Summary of Aging Management Evaluation
- Table 3.5.2-3 Turbine Building, Process Facilities, and Yard Structures—Summary of Aging Management Evaluation
- Table 3.5.2-4 Bulk Commodities—Summary of Aging Management Evaluation

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 structure and commodities tables.

3.5.2.1.1 Reactor Building and Primary Containment

Materials

Reactor building and primary containment components subject to aging management review are constructed of the following materials.

- aluminum
- carbon steel
- concrete
- concrete block
- elastomer
- galvanized steel
- rubber
- stainless steel

Environment

Reactor building and primary containment components subject to aging management review are exposed to the following environments.

- air – indoor uncontrolled
- air – outdoor
- exposed to fluid environment
- soil

Aging Effects Requiring Management

The following aging effects associated with reactor building and primary containment components require management.

- change in material properties
- cracking
- loss of material

Aging Management Programs

The following programs are credited for managing the effects of aging on reactor building and primary containment components.

- Containment Inservice Inspection
- Containment Leak Rate
- Fire Protection
- Inservice Inspection – IWF
- Masonry Wall
- Periodic Surveillance and Preventive Maintenance

- Structures Monitoring
- Water Chemistry Control – BWR

3.5.2.1.2 Water Control Structures

Materials

Water control structures components subject to aging management review are constructed of the following materials.

- carbon steel
- concrete
- galvanized steel
- stainless steel

Environment

Water control structures components subject to aging management review are exposed to the following environments.

- air – indoor uncontrolled
- air – outdoor
- exposed to fluid environment
- soil

Aging Effects Requiring Management

The following aging effects associated with water control structures components require management.

- loss of material

Aging Management Programs

The following aging management programs are credited for managing the aging effects for the water control structures components.

- Fire Protection
- Structures Monitoring

3.5.2.1.3 Turbine Building, Process Facilities, and Yard Structures

Materials

Turbine building, process facilities and yard structures components subject to aging management review are constructed of the following materials.

- aluminum
- carbon steel
- concrete
- concrete block
- crushed rock
- galvanized steel
- treated wood

Environment

Turbine building, process facilities and yard structures components subject to aging management review are exposed to the following environments.

- air – indoor uncontrolled
- air – outdoor
- exposed to fluid environment
- soil

Aging Effects Requiring Management

The following aging effects associated with turbine building, process facilities and yard structures components require management.

- change in material properties
- cracking
- loss of form
- loss of material

Aging Management Programs

The following aging management programs are credited for managing the effects of aging on turbine building, process facilities and yard structures components.

- Fire Protection
- Masonry Wall
- Structures Monitoring

3.5.2.1.4 Bulk Commodities

Materials

Bulk commodities subject to aging management review are constructed of the following materials.

- aluminum
- carbon steel
- cera fiber, cera blanket
- concrete
- elastomer
- fiberglass/calcium silicate
- galvanized steel
- polyvinyl chloride (PVC)
- sand bags
- sealant
- stainless steel
- wood

Environment

Bulk commodities subject to aging management review are exposed to the following environments.

- air – indoor uncontrolled
- air – outdoor
- exposed to fluid environment

Aging Effects Requiring Management

The following aging effects associated with bulk commodities require management.

- change in material properties
- cracking
- cracking/delamination
- loss of material
- separation

Aging Management Programs

The following aging management programs are credited for managing the effects of aging on bulk commodities.

- Fire Protection
- Fire Water System

- Inservice Inspection – IWF
- Structures Monitoring
- Water Chemistry Control – BWR

3.5.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation is necessary for certain aging effects and other issues. Section 3.5.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections, numbered in accordance with the corresponding discussions in NUREG-1800, explain the CNS approach to these areas requiring further evaluation. Programs are described in Appendix B.

3.5.2.2.1 PWR and BWR Containments

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas

CNS has a Mark I free-standing steel containment located within the reactor building. Inaccessible and accessible concrete areas are designed in accordance with American Concrete Institute (ACI) specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions by requiring the following.

- high cement content
- low water-to-cement ratio
- proper curing
- adequate air entrainment

CNS concrete also meets requirements of later ACI guide ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same American Society for Testing and Material (ASTM) standards for selection, application and testing of concrete.

The 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 entrainment and water/cement ratios in accordance with ACI 613 as allowed by ACI 318 to ensure acceptable quality concrete is obtained. Therefore, increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not applicable for concrete in inaccessible areas. The absence of concrete aging effects is confirmed under the Structures Monitoring Program.

3.5.2.2.1.2 Cracks and Distortion due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking and Differential Settlement due to Erosion of Porous Concrete Subfoundations, if Not Covered by Structures Monitoring Program

CNS does not rely on a dewatering system for control of settlement. The CNS reactor building is supported by a reinforced concrete mat foundation constructed on dense structural fill, extending from the bedrock surface to the mat foundation. The CNS secondary containment was not identified in Information Notice 97-11 as susceptible to erosion of porous concrete subfoundations. CNS groundwater is not aggressive and there is no indication that groundwater chemistry has significantly changed and no changes in groundwater conditions have been observed.

As a result, cracking and distortion due to increased stress level from settlement and reduction of foundation strength cracking and differential settlement due to erosion of porous concrete subfoundation are not aging effects requiring management for CNS concrete structures.

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

Not applicable. NUREG-1801 Volume 2 items referencing this issue are associated with concrete containments. CNS has a Mark I steel containment.

3.5.2.2.1.4 Loss of Material due to General, Pitting and Crevice Corrosion

The CNS containment is a Mark I steel containment located within the reactor building. CNS reactor building concrete in contact with the drywell shell is designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete. The concrete meets requirements of later ACI guide ACI 201.2R-77 since both documents use the same ASTM standards for selection, application and testing of concrete. Concrete is monitored for cracks under the Structures Monitoring Program. The drywell steel where the drywell shell becomes embedded in the drywell concrete floor is inspected in accordance with the Containment Inservice Inspection Program and Structures Monitoring Program.

To prevent corrosion of the lower part of the drywell shell, 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 the drywell shell, assuming a crack in the concrete, since the concrete at this location is greater than 8 feet thick and poured in multiple horizontal planes. The sand cushion area is drained to protect the exterior surface of the drywell shell at the sand cushion interface from water that might enter the air gap. Therefore, significant corrosion of the drywell shell is not expected.

3.5.2.2.1.5 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

CNS is a Mark I containment and does not incorporate prestressed concrete in its design. Therefore, loss of prestress due to relaxation, shrinkage, creep, and elevated temperature do not apply.

3.5.2.2.1.6 Cumulative Fatigue Damage

TLAA are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4. Fatigue TLAAs for the torus, torus to drywell vent system and torus penetrations are evaluated as documented in Section 4.6.

3.5.2.2.1.7 Cracking due to Stress Corrosion Cracking

NUREG-1801 recommends further evaluation of inspection methods to detect cracking due to SCC since visual VT-3 examinations may be unable to detect this aging effect. Potentially susceptible components at CNS are penetration sleeves and bellows.

Stress corrosion cracking (SCC) is an aging mechanism that requires the simultaneous action of a corrosive environment, sustained tensile stress, and a susceptible material. Elimination of any one of these elements will eliminate susceptibility to SCC. Stainless steel elements of primary containment and the containment vacuum breakers system, including dissimilar welds, are susceptible to SCC. However, these elements are located inside the containment drywell or outside the drywell, in the reactor building, and are not subject to corrosive environment as discussed below.

The drywell is made inert with nitrogen to render the primary containment atmosphere non-flammable by maintaining the oxygen content below 4% by volume during normal operation. The normal operating average temperature inside the drywell is less than 139°F and the relative humidity range is 20–40%. The reactor building normal operating temperature range is 65°F–92°F, and relative humidity is 100% maximum. Both the containment atmosphere and indoor air environments are non-corrosive (chlorides < 150 ppb, sulfates < 100 ppb, and fluorides < 150 ppb). Thus SCC is not expected to occur in the containment penetration bellows, penetration sleeves, and dissimilar metal welds. A review of plant operating experience did not identify cracking of the components, and primary containment leakage has not been identified as a concern. Therefore the existing Containment Leak Rate Program and Containment Inservice Inspection – IWE are adequate to detect cracking. Observed conditions that have the potential for impacting an intended function are evaluated or corrected in accordance with the corrective action process. The Containment

Inservice Inspection – IWE and Containment Leak Rate programs are described in Appendix B.

3.5.2.2.1.8 Cracking due to Cyclic Loading

Cyclic loading can lead to cracking of steel and stainless steel penetration bellows, and dissimilar metal welds of BWR containments and BWR suppression pool shell and downcomers.

With proper design, cracking due to cyclic loading is not expected to occur in the drywell, torus and associated penetration bellows, penetration sleeves, unbraced downcomers, and dissimilar metal welds. A review of plant operating experience did not identify any cracking of these components, and primary containment leakage has not been identified as a concern. Nonetheless, the existing Containment Leak Rate Program with augmented exams and Containment Inservice Inspection – IWE will continue to be used to detect cracking. Observed conditions that have the potential for impacting an intended function are evaluated or corrected in accordance with the corrective action process. The Containment Inservice Inspection – IWE and Containment Leak Rate programs are described in Appendix B.

3.5.2.2.1.9 Loss of Material (Scaling, Cracking, and Spalling) due to Freeze-Thaw

CNS has a Mark I free-standing steel containment located within the reactor building. Loss of material (scaling, cracking, and spalling) due to freeze-thaw is applicable only to concrete containments exposed to an outdoor environment. Therefore, loss of material and cracking due to freeze-thaw do not apply.

3.5.2.2.1.10 Cracking due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability due to Leaching of Calcium Hydroxide

CNS has a Mark I free-standing steel containment located within the reactor building. In accordance with NUREG-1801, aging management is not required because CNS containment concrete (basemat) is designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, and concrete specification requires that the potential reactivity of aggregates be acceptable based on testing in accordance with ASTM C-227 and C-295.

3.5.2.2.2 <u>Safety-Related and Other Structures and Component Supports</u>

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 of Structures Not Covered by Structures Monitoring Program

CNS concrete structures subject to aging management review are included in the Structures Monitoring Program and supplemented by other aging management programs as appropriate. This is true for concrete items even if the aging management review did not identify aging effects requiring management. Aging effects discussed below for structural steel items are also addressed by the Structures Monitoring Program. Additional discussion of specific aging effects follows.

1. Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-5, 7, 9 Structures

   The aging mechanisms associated with cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are applicable only to below-grade concrete/grout structures. The below-grade environment for CNS is not aggressive and concrete is designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions by providing a high cement content, adequate concrete cover, water/cement ratios that meet specified parameters of ACI 613, proper curing and adequate air content. Therefore, cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not aging effects requiring management for CNS Groups 1-5, 7, 9 structures.

2. Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack for Groups 1-5, 7, 9 Structures

   Aggressive chemical attack becomes significant for concrete exposed to an aggressive environment. Resistance to mild acid attack is enhanced by using a dense concrete with low permeability and adequate concrete cover suitable for the service condition. These groups of structures at CNS use a dense low permeable concrete, adequate concrete cover, and specific water-to-cement ratio, which provides an acceptable degree of protection against aggressive chemical attack. Water chemical analysis results confirm that the site groundwater is considered to be non-aggressive.

   CNS below-grade environment is not aggressive. Therefore, increase in porosity and permeability cracking, loss of material (spalling, scaling) due to aggressive chemical attack are not aging effects requiring management for CNS Groups 1-5, 7, 9 concrete structures.

3. Loss of Material Due to Corrosion for Groups 1-5, 7, 8 Structures

   The CNS Structures Monitoring Program manages loss of material for most steel structural components for CNS Groups 1-5, 7, 8 structures. Protective coatings are not relied upon to manage the effects of aging. In some cases Periodic Surveillance and Preventive Maintenance and Fire Protection Programs supplement the Structures Monitoring Program. The Fire Protection Program uses periodic visual inspections to manage loss of material for some roof decking.

4. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, 7-9 Structures

   CNS is located in moderate to severe weathering condition. Aggregates were in accordance with specifications and materials conforming to ACI and ASTM standards. CNS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios were within the limits provided in ACI 318 63, and air entrainment percentages were within the range prescribed in NUREG-1801. Therefore, loss of material (spalling, scaling) and cracking due to freeze thaw are not aging effects requiring management for CNS Groups 1-3, 5, 7-9 structures.

5. Cracking Due to Expansion and Reaction with Aggregates for Groups 1-5, 7-9 Structures

   Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction, which are in accordance with the recommendations in ACI 201.2R-77 for concrete durability. CNS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios were within the limits provided in ACI 318-63, and air entrainment percentages were within the range prescribed in NUREG-1801. Therefore, cracking due to expansion and reaction with aggregates for Groups 1-5, 7-9 structures is not an aging effect requiring management.

6. Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3, 5-9 Structures

   CNS does not rely on a dewatering system for control of settlement. For Groups 1-3, 5-9 structures at CNS, settlement is not a credible event since structures are founded on bedrock. Therefore, cracks and distortion due to increased stress levels from settlement for Groups 1-3, 5-9 structures is not an aging effect requiring management for CNS concrete.

7. Reduction in Foundation Strength, Cracking, Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1-3, 5-9 Structures

   CNS does not rely on a dewatering system for control of settlement. CNS concrete was provided in accordance with ACI 318-63 requirements resulting in dense, well-cured, high-strength concrete with low-permeability. Structures are supported on dense, consolidated fill and erosion of the subfoundation is not credible since the subfoundation is also eliminating the possibility of loss of soil that results in voids below the subgrade. Fluid leakage across the subfoundation is captured by drains provided in the base slab and inspected for any material loss. Operating history has not identified any losses to date and, therefore, reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation are not aging effects requiring management for CNS Groups 1 3, 5-9 structures.

8. Lock Up Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

   Owing to the wear-resistant material used, the low frequency (number of times) of movement, and the slow movement between sliding surfaces, lock-up due to wear is not an aging effect requiring management at CNS. CNS does not utilize Lubrite plates in the drywell beam seats; therefore, there are none requiring aging management. However, sliding support surfaces associated with the torus ring girder are included within the Structures Monitoring Program and Inservice Inspection – IWF Programs to confirm the absence of aging effects requiring management for this component.

3.5.2.2.2.2 Aging Management of Inaccessible Areas

CNS concrete for Group 1-3, 5 and 7-9 inaccessible concrete areas was provided in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which requires the following, resulting in low permeability and resistance to aggressive chemical solution.

- high cement content
- low water permeability
- proper curing
- adequate air entrainment

CNS concrete also meets requirements of later ACI guide ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same ASTM standards for selection, application and testing of concrete.

Inspections of accessible concrete have not revealed degradation related to corrosion of embedded steel. CNS below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, corrosion of embedded steel is not an aging effect requiring management for CNS concrete.

3.5.2.2.2.3 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

For reduction of strength and modulus of concrete structures due to elevated temperatures for Groups 1-5, NUREG-1801 recommends a plant-specific AMP and further evaluation if the general temperature is greater than 150ºF or if the local temperature is greater than 200ºF. During normal operation, bulk average temperature of Groups 1-5 concrete elements is maintained below 150ºF and local temperatures remain below 200ºF.

Group 1-5 concrete elements remain at temperatures below the 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 for CNS.

3.5.2.2.2.4 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. Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/Aggressive Chemical Attack; and Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel in Below-Grade Inaccessible Concrete Areas of Group 6 Structures

   Below-grade exterior reinforced concrete at CNS 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, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel are not aging effects requiring management for below-grade inaccessible concrete areas of CNS Group 6 structures.

2. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-thaw in Below-Grade Inaccessible Concrete Areas of Group 6 Structures

   Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction.

CNS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios were within the limits provided in ACI 318, and air entrainment percentages were within the range prescribed in NUREG-1801. Therefore, loss of material (spalling, scaling) and cracking due to freeze thaw are not aging effects requiring management for CNS Groups 6 structures.

3. Cracking due to Expansion and Reaction with Aggregates, Increase in Porosity and Permeability, and Loss of Strength Due to Leaching of Calcium Hydroxide in Below-Grade Inaccessible Concrete Areas of Group 6 Structures

   Aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction, which are in accordance with the recommendations in ACI 201.2R-77 for concrete durability. CNS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water/cement ratios were within the limits provided in ACI 318-63, and air entrainment percentages were within the range prescribed in NUREG-1801. CNS 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, increase in porosity and permeability due to leaching of calcium hydroxide in below grade inaccessible concrete areas of Group 6 Structures is not an aging effect requiring management for CNS concrete.

3.5.2.2.2.5 Cracking due to Stress Corrosion Cracking and Loss of Material due to Pitting and Crevice Corrosion

NUREG-1800 Section 3.5.2.2.2.5 applies to stainless steel liners for concrete or steel tanks. No tanks with stainless steel liners are included in the scope of license renewal. However, the corresponding NUREG-1801 items can be compared to the stainless steel liners of the reactor cavity and drywell sump. These liners can be exposed to a fluid environment and may be subject to loss of material. The fluid temperatures are below the threshold for stress corrosion cracking. The Structures Monitoring Program manages loss of material by periodic inspections.

3.5.2.2.2.6 Aging of Supports Not Covered by Structures Monitoring Program

NUREG-1801 recommends further evaluation of certain component support/aging effect combinations if they are not covered by the applicant's structure monitoring program. Component supports at CNS are included in the Structures Monitoring Program for Groups B1 through B5.

(1) Reduction in concrete anchor capacity due to degradation of the surrounding concrete for Groups B1 through B5 supports

CNS concrete components are designed in accordance with accepted ACI standards. Plant experience has not identified reduction in concrete anchor capacity or other concrete aging mechanisms. Nonetheless, the Structures Monitoring Program will confirm absence of aging effects requiring management for CNS concrete components. CNS concrete anchors and surrounding concrete are included in the Structures Monitoring Program (Groups B1 through B5).

(2) Loss of material due to general and pitting corrosion, for Groups B2 through B5 supports

Loss of material due to corrosion of steel support components is an aging effect requiring management at CNS. The Structures Monitoring Program manages loss of material for steel structural components. For some components the Fire Protection Program supplements the Structures Monitoring Program. For some components, the Periodic Surveillance and Preventive Maintenance, Fire Protection or Fire Water System Programs manage loss of material using periodic visual inspections.

(3) Reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports

The CNS aging management review did not identify any component support structure/aging effect combination corresponding to NUREG-1801 Volume 2 Item III.B4.2-a.

3.5.2.2.2.7 Cumulative Fatigue Damage due to Cyclic Loading

TLAA are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4. During the process of identifying TLAAs in the CNS current licensing basis, no fatigue analyses were identified for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of CNS quality assurance procedures and administrative controls for aging management programs.

3.5.2.3 Time-Limited Aging Analyses

Potential TLAA identified for structural components and commodities include fatigue analyses for drywell to torus vent system, torus shell, and torus penetrations. The fatigue analyses for these systems and components were determined to be TLAA. 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 Programs for Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
PWR Concrete (Reinforced and Prestressed) and Steel Containment BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment					
3.5.1-1	Concrete elements: walls, dome, basemat, ring girder, buttresses, containment (as applicable).	Aging of accessible and inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	ISI (IWL) and for inaccessible concrete, an examination of representative samples of below-grade concrete and periodic monitoring of groundwater if environment is nonaggressive. A plant specific program is to be evaluated if environment is aggressive.	Yes, plant-specific, if the environment is aggressive	The listed concrete elements apply to PWR containments and concrete BWR containments. The CNS containment is a Mark I steel containment. See Section 3.5.2.2.1.1.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-2	Concrete elements; All	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. 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 not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. The CNS containment is a steel containment. Concrete elements are limited to floor slab and reactor vessel pedestal. These elements are not subject to the listed aging effect because they are founded on the reactor building base slab. See Section 3.5.2.2.1.2.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-3	Concrete elements: foundation, subfoundation	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a dewatering system is relied upon to control erosion of cement from porous concrete subfoundations, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. The CNS containment is a Mark I steel containment. See Section 3.5.2.2.1.2.
3.5.1-4	Concrete elements: dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable)	Reduction of strength and modulus due to elevated temperature	A plant-specific aging management program is to be evaluated	Yes, plant-specific if temperature limits are exceeded	NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. CNS has a Mark I steel containment. See Section 3.5.2.2.1.3.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-5	Steel elements: Drywell; torus; drywell head; embedded shell and sand pocket regions; drywell support skirt; torus ring girder; downcomers; liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor, suppression chamber (as applicable)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes, if corrosion is significant for inaccessible areas	Consistent with NUREG-1801. The Containment Inservice Inspection and Containment Leak Rate Programs will manage this aging effect. Corrosion is not significant for inaccessible areas (i.e., drywell steel shell). To prevent corrosion of the lower part of the drywell, the interior and exterior surfaces are protected from contact with the atmosphere by complete concrete encasement. Concrete is designed in accordance with ACI standards and monitored under the Structures Monitoring Program. The drywell steel where the drywell shell becomes embedded in the drywell concrete floor is inspected in accordance with the Containment Inservice Inspection Program and Structures Monitoring Program. See Section 3.5.2.2.1.4.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-6	Steel elements: steel liner, liner anchors, integral attachments	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes, if corrosion is significant for inaccessible areas	NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. The CNS containment is a Mark I steel containment. See Section 3.5.2.2.1.4.
3.5.1-7	Prestressed containment tendons	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. The CNS containment is a Mark I steel containment. See Section 3.5.2.2.1.5.
3.5.1-8	Steel and stainless steel elements: vent line, vent header, vent line bellows; downcomers	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue analysis is a TLAA for the torus shell and the torus to drywell vent system. See Section 3.5.2.2.1.6.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-9	Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue analysis is a TLAA for the torus penetrations. See Section 3.5.2.2.1.6.
3.5.1-10	Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J and additional appropriate examinations/ evaluations for bellows assemblies and dissimilar metal welds	Yes, detection of aging effects is to be evaluated	Cracking due to SCC is not an applicable aging mechanism for these primary containment components at CNS. Nonetheless, components are included in the Containment Inservice Inspection and Containment Leak Rate Programs to verify the absence of other aging effects, such as cracking, for components in this group listing. The Containment Inservice Inspection Program includes augmented exams to detect fine cracks. See Section 3.5.2.2.1.7.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-11	Stainless steel vent line bellows	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examination/ evaluation for bellows assemblies and dissimilar metal welds	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Cracking due to SCC is not an applicable aging mechanism for stainless steel vent line bellows at CNS. Nonetheless, the drywell to torus vent line bellows are included in the Containment Inservice Inspection and Containment Leak Rate Programs to verify the absence of other aging effects, such as cracking. The Containment Inservice Inspection Program includes augmented ultrasonic exams to detect fine cracks. See Section 3.5.2.2.1.7.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-12	Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J supplemented to detect fine cracks	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. With proper design, cracking due to cyclic loading is not expected to occur. Nonetheless, the Containment Leak Rate Program with augmented exams and Containment Inservice Inspection will continue to be used to detect cracking. The Containment Inservice Inspection Program includes augmented exams to detect fine cracks. See Section 3.5.2.2.1.8.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-13	Steel, stainless steel elements, dissimilar metal welds: torus; vent line; vent header; vent line bellows; downcomers	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J supplemented to detect fine cracks	Yes, detection of aging effects is to be evaluated	With proper design, cracking due to cyclic loading is not expected to occur. Nonetheless, the Containment Leak Rate Program with augmented exams and Containment Inservice Inspection will continue to be used to detect cracking. The Containment Inservice Inspection Program includes augmented ultrasonic exams to detect fine cracks. See Section 3.5.2.2.1.8.
3.5.1-14	Concrete elements: dome, wall, basemat ring girder, buttresses, containment (as applicable)	Loss of material (Scaling, cracking, and spalling) due to freeze-thaw	ISI (IWL) 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	NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. The CNS containment is a Mark I steel containment. See Section 3.5.2.2.1.9.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-15	Concrete elements: walls, dome, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable).	Cracking due to expansion and reaction with aggregate; increase in porosity, permeability due to leaching of calcium hydroxide	ISI (IWL) for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas	NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. The CNS containment is a Mark I steel containment. See Section 3.5.2.2.1.10.
3.5.1-16	Seals, gaskets, and moisture barriers	Loss of sealing and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	ISI (IWE) and 10 CFR Part 50, Appendix J	No	The aging effects cited in the NUREG-1801 item are loss of sealing and leakage. Loss of sealing is a consequence of the aging effects cracking and change in material properties. For CNS, the Containment Leak Rate, Containment Inservice Inspection, Structures Monitoring and Periodic Surveillance and Preventive Maintenance programs manage cracking and change in material properties.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-17	Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanisms	10 CFR Part 50, Appendix J and Plant Technical Specifications	No	Locks, hinges, and closure mechanisms are active components and are therefore not subject to aging management review. 10 CFR Part 50, Appendix J, and CNS technical specifications require testing to ensure leak tightness of airlocks and hatches.
3.5.1-18	Steel penetration sleeves and dissimilar metal welds; personnel airlock, equipment hatch and CRD hatch	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Consistent with NUREG-1801. The Containment Inservice Inspection and Containment Leak Rate Programs will manage this aging effect.
3.5.1-19	Steel elements: stainless steel suppression chamber shell (inner surface)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J	No	This is applicable to stainless steel suppression chambers. The CNS suppression chamber is carbon steel.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-20	Steel elements: suppression chamber liner (interior surface)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	NUREG-1801 Volume 2 items referencing this item are associated with concrete containments. The CNS containment is a Mark I steel containment.
3.5.1-21	Steel elements: drywell head and downcomer pipes	Fretting or lock up due to mechanical wear	ISI (IWE)	No	Loss of material is the aging effect caused by mechanical wear. CNS plant operating experience has not identified fretting or lock up due to mechanical wear for the drywell head and downcomers. CNS inspects the drywell head and downcomers per the requirements of ASME Section XI. In addition, the drywell head is a stationary or fixed component and the downcomers are stationary, well-braced components and the special distance between connecting components makes it unlikely for fretting and lock up to occur.

Table 3.5.1:	Structures and Component Supports, NUREG-1801 Vol. 1				
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-22	Prestressed containment: tendons and anchorage components	Loss of material due to corrosion	ISI (IWL)	No	The CNS containment is a Mark I steel containment without prestressed tendons.
Safety-Related and Other Structures; and Component Supports					
3.5.1-23	All Groups except Group 6: interior and above grade exterior concrete	Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	Corrosion of embedded steel becomes significant if exposed to an aggressive environment. Corrosion is not significant if the concrete has a low water-to-cement ratio, low permeability, and is designed in accordance with ACI Standards (ACI-318 or ACI-349). Loss of bond is included with cracking for the purpose of this review. The design and construction of these structures at CNS prevents corrosion of embedded steel. Nonetheless, components are included in the Structures Monitoring Program. See Section 3.5.2.2.2.1 Item 1.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-24	All Groups except Group 6: interior and above grade exterior concrete	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	Listed aging effects do not require management at CNS. Nonetheless, components are included in the Structures Monitoring Program. See Section 3.5.2.2.2.1 Item 2.
3.5.1-25	All Groups except Group 6: steel components: all structural steel	Loss of material due to corrosion	Structures Monitoring Program. 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.	Yes, if not within the scope of the applicant's structures monitoring program	Consistent with NUREG-1801 for most components. The Structures Monitoring Program manages loss of material for steel structural components. Protective coatings are not relied upon to manage the effects of aging. In some cases Periodic Surveillance and Preventive Maintenance and Fire Protection Programs supplement the Structures Monitoring Program. The Fire Protection Program manages loss of material for some roof decking. See Section 3.5.2.2.2.1 Item 3.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-26	All Groups except Group 6: accessible and inaccessible concrete: foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Structures Monitoring Program. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557).	Yes, if not within the scope of the applicant's structures monitoring program or for plants located in moderate to severe weathering conditions	CNS is located in moderate to severe weathering zone; however, freeze-thaw is not an applicable aging mechanism for these groups of structures at CNS. Nonetheless, components are included in the Structures Monitoring Program. See Section 3.5.2.2.2.1 Item 4.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-27	All Groups except Group 6: accessible and inaccessible interior/exterior concrete	Cracking due to expansion due to reaction with aggregates	Structures Monitoring Program None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if not within the scope of the applicant's structures monitoring program or concrete was not constructed as stated for inaccessible areas	Cracking due to expansion due to reaction with aggregates does not require aging management for concrete for these groups of structures at CNS, because concrete is constructed in accordance with the recommendations in ACI 201.2R-77. Nonetheless, components are included in the Structures Monitoring Program. The Fire Protection Program supplements the Structures Monitoring Program for flood curbs. See Section 3.5.2.2.2.1 Item 5.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-28	Groups 1-3, 5-9: all	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. 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 not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	CNS structures are constructed on dense structural fill, extending from the bedrock surface to the mat foundation, preventing settlement of the structure. Plant operating experience has not identified settlement of structures resulting in cracks and distortion of component structures; therefore, cracks and distortion are not aging effects requiring management. Nonetheless, components are included in the Structures Monitoring Program. See Section 3.5.2.2.2.1 Item 6.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-29	Groups 1-3, 5-9: foundation	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. 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 not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	CNS structures are constructed on dense structural fill, extending from the bedrock surface to the mat foundation, preventing settlement of the structure. Plant operating experience has not identified settlement of structures resulting is cracks and distortion of component structures; therefore, the listed aging effects do not require management. See Section 3.5.2.2.2.1 Item 7.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-30	Group 4: Radial beam seats in BWR drywell; RPV support shoes for PWR with nozzle supports; Steam generator supports	Lock-up due to wear	ISI (IWF) or Structures Monitoring Program	Yes, if not within the scope of ISI or structures monitoring program	NUREG-1801 Volume 2 item referencing this item is associated with Lubrite plates. CNS does not utilize Lubrite plates in the drywell beam seats therefore, there are none requiring aging management. Nonetheless, components associated with the drywell beam seats are included in the Structures Monitoring Program. CNS is a BWR and does not contain those components associated with PWR. See Section 3.5.2.2.2.1 Item 8.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-31	Groups 1-3, 5, 7-9: below-grade concrete components, such as exterior walls below grade and foundation	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; Cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel	Structures Monitoring Program; Examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive.	Yes, plant-specific, if environment is aggressive	CNS concrete has specific water-to-cement ratios as defined by ACI 613 (and allowed by ACI 318), low permeability, and is designed in accordance with ACI Standards (ACI-318 or ACI-349). The design and construction of these groups of structures at CNS prevents the effect of this aging from occurring; therefore, this aging effect does not require management. Loss of bond is included with cracking for the purpose of this review. Aging effects are not significant for accessible and inaccessible below-grade areas. Nonetheless, components are included in the Structures Monitoring Program. See Section 3.5.2.2.2.2.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-32	Groups 1-3, 5, 7-9: exterior above and below grade reinforced concrete foundations	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide.	Structures Monitoring Program for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas	CNS concrete has specific water-to-cement ratios as defined by ACI 613 (and allowed by ACI 318), low permeability, and is designed in accordance with ACI Standards (ACI-318 or ACI-349). The design and construction of these groups of structures at CNS prevents the effect of this aging from occurring; therefore, this aging effect does not require management. Nonetheless, components are included in the Structures Monitoring Program. See Section 3.5.2.2.2.2.
3.5.1-33	Groups 1-5: concrete	Reduction of strength and modulus due to elevated temperature	Plant-specific	Yes, plant-specific if temperature limits are exceeded	CNS concrete elements do not exceed specified temperature limits. See Section 3.5.2.2.2.3.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-34	Group 6: Concrete; all	Increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack; Cracking, loss of bond, loss of material due to corrosion of embedded steel	Insp of Water-Control Structures or [Federal Energy Regulatory Commission] FERC/US Army Corps of Engineers dam inspections and maintenance programs, and for inaccessible concrete, exam of rep. samples of below-grade concrete, and periodic monitoring of groundwater, if environment is non-aggressive. Plant specific if environment is aggressive.	Yes, plant-specific if environment is aggressive	The listed aging effects are not significant for accessible and inaccessible areas because CNS ground water is non-aggressive. Loss of bond is included with cracking for the purpose of this review. The Structures Monitoring Program will confirm the absence of aging effects requiring management for CNS Group 6 components exposed to a fluid environment. See Section 3.5.2.2.2.4 Item 1.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-35	Group 6: exterior above and below grade concrete foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. 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	Aging effects are not significant for accessible and inaccessible areas. These concrete structures are exposed to saturated water conditions near the ground surface; however, the concrete used at CNS is designed in accordance with ACI-613 as allowed by ACI-318, and plant experience has not identified any degradation related to freeze-thaw. Nonetheless, the Structures Monitoring Program will confirm the absence of aging effects requiring management for CNS Group 6 concrete components. See Section 3.5.2.2.2.4 Item 2.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-36	Group 6: all accessible/ inaccessible reinforced concrete	Cracking due to expansion/ reaction with aggregates	Accessible areas: Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas	Reaction with aggregates is not an applicable aging mechanism for CNS concrete components. See Section 3.5.2.2.2.1 Item 5 (although for Groups 1-5, 7, 9 this discussion is also applicable for Group 6). Nonetheless, the Structures Monitoring Program will confirm the absence of aging effects requiring management for CNS Group 6 concrete components. See Section 3.5.2.2.2.4 Item 3.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-37	Group 6: exterior above and below grade reinforced concrete foundation interior slab	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	For accessible areas, Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas	Concrete was constructed in accordance with the recommendations in ACI 201.2R-77. Nonetheless the Structures Monitoring Program will confirm the absence of aging effects requiring management for CNS Group 6 concrete components. See Section 3.5.2.2.2.4 Item 3.
3.5.1-38	Groups 7, 8: Tank liners	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	Plant-specific	Yes, plant specific	The Structures Monitoring Program will manage loss of material for the stainless steel liners of the reactor cavity and drywell sump. See Section 3.5.2.2.2.5.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-39	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	Consistent with NUREG-1801 for most components. The Structures Monitoring Program manages loss of material for steel structural components. For some components the Fire Protection Program supplements the Structures Monitoring Program. For some components, the Fire Protection or Fire Water System Programs manage loss of material. See Section 3.5.2.2.2.6 Item 2.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-40	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	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	CNS concrete components are designed in accordance with accepted ACI standards. Plant experience has not identified reduction in concrete anchor capacity or other concrete aging mechanisms. Nonetheless, the Structures Monitoring Program will confirm absence of aging effects requiring management for CNS concrete components. See Section 3.5.2.2.2.6 Item 1.
3.5.1-41	Vibration isolation elements	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	No vibration isolation elements at CNS are in scope and subject to aging management review. See Section 3.5.2.2.2.6 Item 3.
3.5.1-42	Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	No CLB fatigue analysis exists. See Section 3.5.2.2.2.7.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-43	Groups 1-3, 5, 6: all masonry block walls	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	No	Consistent with NUREG-1801 for most masonry walls. The Masonry Wall Program manages this aging effect. In some cases within the reactor building, the Fire Protection Program supplements the Masonry Wall Program. For fire barrier masonry walls outside the reactor building, the Fire Protection Program manages this aging effect by periodic inspections.
3.5.1-44	Group 6 elastomer seals, gaskets, and moisture barriers	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	No	Consistent with NUREG-1801. Loss of sealing is a consequence of elastomer cracking and change in material properties. Component types include compressible joints and seals and gaskets. The Structures Monitoring Program manages cracking and change in material properties.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-45	Group 6: exterior above and below grade concrete foundation; interior slab	Loss of material due to abrasion, cavitation	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance	No	Abrasion and cavitation due to flowing water are insignificant at CNS due to the low flow velocities for these structures. Nonetheless, the Structures Monitoring Program will confirm absence of aging effects requiring management for CNS Group 6 concrete components.
3.5.1-46	Group 5: Fuel pool liners	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	Water Chemistry and Monitoring of spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channel.	No	At CNS, the Water Chemistry Control – BWR Program manages aging effects on the spent fuel pool liner. Monitoring spent fuel pool water level in accordance with technical specifications and monitoring leakage from the leak test channels will also continue during the period of extended operation. Cracking due to stress corrosion is not an aging effect requiring management for treated water < 140°F. There are no stainless steel spent fuel components with intended functions exposed to treated water > 60°C (> 140°F).

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-47	Group 6: all metal structural members	Loss of material due to general (steel only), pitting and crevice corrosion	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included.	No	The listed aging management program is not used. The Structures Monitoring Program will confirm absence of aging effects requiring management for CNS Group 6 steel components.
3.5.1-48	Group 6: 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	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs.	No	CNS does not have earthen water control structures.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-49	Support members; welds; bolted connections; support anchorage to building structure	Loss of material/ general, pitting, and crevice corrosion	Water Chemistry and ISI (IWF)	No	Consistent with NUREG-1801. The CNS Water Chemistry Control – BWR and Inservice Inspection – IWF Programs manage this aging effect.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-50	Groups B2, and B4: galvanized steel, aluminum, stainless steel support members; welds; bolted connections; support anchorage to building structure	Loss of material due to pitting and crevice corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801 for galvanized steel components in outdoor air. The Structures Monitoring Program will manage loss of material. Loss of material is not an applicable aging effect for stainless steel or aluminum components in outdoor air. The ambient environment at CNS is not chemically polluted by vapors of sulfur dioxide or other similar substances and the external environment does not contain saltwater or high chlorides. Therefore, loss of material due to pitting and crevice corrosion is not an aging effect requiring management for aluminum and stainless steel components exposed to the external environment.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-51	Group B1.1: high strength low-alloy bolts	Cracking due to stress corrosion cracking; loss of material due to general corrosion	Bolting Integrity	No	SCC of high strength anchor bolts is not an aging effect requiring management at CNS for two reasons. (1) CNS does not utilize high strength bolting in structural applications; the bolting used is not exposed to a corrosive environment or high tensile stresses. (2) Bolting connections are installed with friction-type contact surfaces via the turn-of-the-nut method; therefore, for bolts greater than 1" in diameter, a significant preload (in the order of 70% of ultimate strength) is not practical to develop. The CNS Inservice Inspection – IWF Program manages loss of material for bolting connections.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-52	Groups B2, and B4: sliding support bearing and sliding support surfaces	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Structures Monitoring Program	No	Loss of mechanical function due to the listed mechanisms is not an aging effect. Such failures typically result from inadequate design or operating events rather than from the effects of aging. Failures due to cyclic thermal loads are rare for structural supports due to their relatively low temperatures.
3.5.1-53	Groups B1.1, B1.2, and B1.3: support members: welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	ISI (IWF)	No	Consistent with NUREG-1801. The CNS Inservice Inspection – IWF Program manages this aging effect.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-54	Groups B1.1, B1.2, and B1.3: 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	ISI (IWF)	No	Loss of mechanical function due to distortion, dirt, overload, fatigue due to vibratory, and cyclic thermal loads is not an aging effect requiring management. Such failures typically result from inadequate design or events rather than the effects of aging. Loss of material due to corrosion, which could cause loss of mechanical function, is addressed under Item 3.5.1-53 for Groups B1.1, B1.2, and B1.3 support members.
3.5.1-55	PWR only				

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-56	Groups B1.1, B1.2, and B1.3: Sliding surfaces	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	The NUREG-1801 line item makes reference to Lubrite materials. Lubrite plates are not used in the torus support saddles at CNS. Therefore, the listed aging effect is not applicable. Nonetheless, sliding support components associated with the torus supports are included in the CNS Inservice Inspection – IWF Program.
3.5.1-57	Groups B1.1, B1.2, and B1.3: Vibration isolation elements	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	ISI (IWF)	No	No supports with vibration isolation elements have been identified in the scope of license renewal for CNS.
3.5.1-58	Galvanized steel and aluminum support members; welds; bolted connections; support anchorage to building structure exposed to air - indoor uncontrolled	None	None	None NA - No AEM or AMP	Consistent with NUREG-1801 for galvanized steel components. There are no aluminum support components exposed to indoor air with an intended function for license renewal.

Table 3.5.1: Structures and Component Supports, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-59	Stainless steel support members; welds; bolted connections; support anchorage to building structure	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.

Notes for Table 3.5.2-1 through 3.5.2-4

Generic Notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program 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 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

501. The CNS environment is not conducive to the aging effects listed in NUREG-1801. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation.

502. Loss of insulating characteristics due to insulation degradation is not an aging effect requiring management for insulation material. Insulation products, which are made from fiberglass fiber, calcium silicate, stainless steel, and similar materials, that are protected from weather do not experience aging effects that would significantly degrade their ability to insulate as designed. A review of site operating experience identified no aging effects for insulation used at CNS.

503. The ambient environment at CNS is not chemically polluted by vapors of sulfur dioxide or other similar substances and the external environment does not contain saltwater or high chloride content. Therefore, aging management is not required for aluminum and stainless steel components exposed to the external environment.

504 The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program.

Table 3.5.2-1
Reactor Building and Primary Containment
Summary of Aging Management Evaluation

Table 3.5.2-1: Reactor Building and Primary Containment								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
CRD removal hatch	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4-6 (C-16)	3.5.1-18	B
CRD shootout steel	EN	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	C
Drywell equipment hatches	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4-6 (C-16)	3.5.1-18	B
Drywell head	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Drywell head access hatch	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4-6 (C-16)	3.5.1-18	B
Drywell personnel access lock	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4-6 (C-16)	3.5.1-18	B

Table 3.5.2-1: Reactor Building and Primary Containment

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Drywell shell	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Drywell shell protection panels and jet deflectors	MB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	C
Drywell stabilizer supports	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	C
Drywell sump liner	EN, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A7-11 T-23	3.5.1-38	E
Drywell to torus vent line bellows	PB, SSR	Stainless steel	Air – indoor uncontrolled	Cracking	CII-IWE Containment Leak Rate	II.B1.1-5 (C-22)	3.5.1-11	B
Drywell to torus vent system	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Drywell to torus vent system	PB, SSR	Carbon steel	Exposed to fluid environment	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Drywell to torus vent system	PB, SSR	Carbon steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B1.1-4 (C-21)	3.5.1-8	A

Table 3.5.2-1: Reactor Building and Primary Containment								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Metal siding	EN, PB	Galvanized steel	Air – indoor uncontrolled	None	None	III.B5-3 (TP-11)	3.5.1-58	A
Metal siding	EN, PB	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B4-7 (TP-6)	3.5.1-50	C
Monorails	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Periodic Surveillance and Preventive Maintenance	VII B-3 (A-07)	3.3.1-73	E
Personnel airlock, equipment hatch, CRD hatch and drywell head bolting	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Primary containment electrical penetrations	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4-1 (C-12)	3.5.1-18	B
Primary containment mechanical penetrations (includes those with bellows)	PB, SSR	Carbon steel	Air – indoor uncontrolled	Cracking	CII-IWE Containment Leak Rate	II.B4-3 (C-14)	3.5.1-12	B

Table 3.5.2-1: Reactor Building and Primary Containment								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Primary containment mechanical penetrations (includes those with bellows)	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4-1 (C-12)	3.5.1-18	B
Railroad airlock doors	EN, FB, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring Periodic Surveillance and Preventive Maintenance Fire Protection	III.A1-12 (T-11)	3.5.1-25	C
Reactor building crane, rails and girders	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Periodic Surveillance and Preventive Maintenance	VII B-3 (A-07)	3.3.1-73	E
Reactor building loop seal drain caps	PB, SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	A
Reactor building sump liner and penetrations	EN, PB, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B1.3-7 (TP-5)	3.5.1-59	C
Reactor cavity liner	EN, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A7-11 T-23	3.5.1-38	E

Table 3.5.2-1: Reactor Building and Primary Containment

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor vessel stabilizer assembly	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1-13 (T-24)	3.5.1-53	B
Reactor vessel support assembly	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1-13 (T-24)	3.5.1-53	B
Refueling bridge equipment assembly	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.B-3 (A-07)	3.3.1-73	E
Sacrificial shield wall lateral supports	EN, MB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	A
Sacrificial shield wall (steel portion)	EN, MB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	A
Spent fuel pool liner plate	EN, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR Monitoring of spent fuel pool level per Tech Spec and monitoring leakage from leak chase channel	III.A5-13 (T-14)	3.5.1-46	A
Spent fuel pool gate	EN, SSR	Aluminum	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR	VII.A4-5 (AP-38)	3.3.1-24	C, 504

Table 3.5.2-1: Reactor Building and Primary Containment								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Spent fuel pool storage racks	SSR	Aluminum	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR	VII.A4-5 (AP-38)	3.3.1-24	C, 504
Spent fuel pool storage racks	SSR	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR	VII.A4-11 (A-58)	3.3.1-24	C, 504
Structural steel: beams, columns and plates	EN, FB, MB, SNS, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring Fire Protection	III.A1-12 (T-11)	3.5.1-25	C
Torus electrical penetrations	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4-1 (C-12)	3.5.1-18	B
Torus external supports (saddles, columns)	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1-13 (T-24)	3.5.1-53	B
Torus manway cover	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Torus mechanical penetrations	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4-1 (C-12)	3.5.1-18	B
Torus mechanical penetrations	PB, SSR	Carbon steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B4-4 (C-13)	3.5.1-9	A

Table 3.5.2-1: Reactor Building and Primary Containment								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Torus ring girder	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Torus ring girder	SSR	Carbon steel	Exposed to fluid environment	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Torus shell	HS, PB, SSR	Carbon steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B1.1-4 (C-21)	3.5.1-8	A
Torus shell	HS, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Torus shell	HS, PB, SSR	Carbon steel	Exposed to fluid environment	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Torus thermowells	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1-2 (C-19)	3.5.1-5	B
Vent header support	SSR	Carbon steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR ISI-IWF	III.B1.1-11 (TP-10)	3.5.1-49	B

Table 3.5.2-1: Reactor Building and Primary Containment

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Beams, columns, floor slabs, and interior walls	EN, FB, FLB, MB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501
Biological shield wall	EN, MB, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Blowout panels (east end of steam tunnel)	EN, PB, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Drywell fill slab	SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Drywell sumps	SSR	Concrete	Exposed to fluid environment	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Exterior walls	EN, FB, FLB, MB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501
Exterior walls	EN, FB, FLB, MB, PB, SNS, SRE, SSR	Concrete	Air – outdoor	None	Structures Monitoring Fire Protection	VII.G-30 (A-92)	3.3.1-66	I, 501
Exterior walls (below grade)	FLB, MB, PB, SNS, SRE, SSR	Concrete	Soil	None	Structures Monitoring	II.A1-4 (T-05)	3.5.1-31	I, 501

Table 3.5.2-1: Reactor Building and Primary Containment								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Foundation	FLB, PB, SNS, SRE, SSR	Concrete	Soil	None	Structures Monitoring	II.A1-4 (T-05)	3.5.1-31	I, 501
Masonry walls	EN, FB, MB, SNS, SSR	Concrete block	Air – indoor uncontrolled	Cracking	Masonry Wall Fire Protection	III.A1-11 (T-12)	3.5.1-43	A
New fuel storage vault	EN, MB, SNS	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Reactor building sump structure	SSR	Concrete	Exposed to fluid environment	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Reactor cavity floor and wall	EN, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Reactor pedestal	SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Shield plugs	EN, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Spent fuel pool floor and wall	EN, MB, SNS, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 (T-03)	3.5.1-27	I, 501
Steam tunnel	FB, MB, SNS, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501

Table 3.5.2-1: Reactor Building and Primary Containment

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steam tunnel	FB, MB, SNS, SSR	Concrete	Soil	None	Structures Monitoring Fire Protection	III.A1-4 (T-05)	3.5.1-31	I, 501
Moisture barrier	EN, SSR	Elastomer	Air – indoor uncontrolled	Cracking Change in material properties	CII-IWE Containment Leak Rate	II.B4-7 (C-18)	3.5.1-16	B
Primary containment electrical penetration seals and sealant	PB, SSR	Elastomer	Air – indoor uncontrolled	Cracking Change in material properties	Containment Leak Rate	II.B4-7 (C-18)	3.5.1-16	E
Rubber seal for railroad airlock doors	PB, SSR	Rubber	Air – indoor uncontrolled	Cracking Change in material properties	Periodic Surveillance and Preventive Maintenance	II B4-7 (C-18)	3.5.1-16	E

Table 3.5.2-2
Water Control Structures
Summary of Aging Management Evaluation

Table 3.5.2-2: Water Control Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Guide wall	EN	Carbon steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Pump baffle plates	SNS	Stainless steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Structural steel, beams, columns, and plates	EN, SNS, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B5-3 (TP-11)	3.5.1-58	A
Structural steel, beams, columns, and plates	EN, SNS, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Structural steel, beams, columns, and plates	EN, SNS, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Structural steel, beams, columns, and plates	EN, SNS, SSR	Carbon steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Structural steel, beams, columns, and plates	EN, SNS, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E

Table 3.5.2-2: Water Control Structures

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Traveling screen casing and associated framing	SNS	Carbon steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Beams, columns, floor slabs and walls (above grade)	FB, HS, MB, SNS, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501
Beams, columns, floor slabs and walls (above grade)	FB, HS, MB, SNS, SSR	Concrete	Air – outdoor	None	Structures Monitoring Fire Protection	VII.G-30 (A-92)	3.3.1-66	I, 501
Beams, columns, floor slabs and walls (below grade)	HS, SNS, SSR	Concrete	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-7 (T-20)	3.5.1-45	E
Exterior walls above grade	FB, MB, SNS, SRE, SSR	Concrete	Air – outdoor	None	Structures Monitoring Fire Protection	III.A6-2 (T-17)	3.5.1-36	I, 501
Exterior walls below grade	HS, SNS, SSR	Concrete	Soil	None	Structures Monitoring	III.A6-7 (T-20)	3.5.1-45	I, 501
Exterior walls below grade	HS, SNS, SSR, SRE	Concrete	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-7 (T-20)	3.5.1-45	E
Foundation	SNS, SSR	Concrete	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-7 (T-20)	3.5.1-45	E

Table 3.5.2-2: Water Control Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Foundation	SNS, SRE, SSR	Concrete	Soil	None	Structures Monitoring	III.A6-3 (T-19)	3.5.1-34	I, 501
Roof hatches	EN, FB, MB, SNS, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501
Roof slab	EN, FB, MB, SNS, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501
SW pipe slab	SNS	Concrete	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-7 (T-20)	3.5.1-45	E

Table 3.5.2-3
Turbine Building, Process Facilities, and Yard Structures
Summary of Aging Management Evaluation

Table 3.5.2-3: Turbine Building, Process Facilities, and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Blowout panels	SNS	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A3-12 (T-11)	3.5.1-25	C
Blowout panels	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A3-12 (T-11)	3.5.1-25	C
Control room ceiling support system	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A1-12 (T-11)	3.5.1-25	C
Crane rails and girders	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	VII.B-3 (A-07)	3.3.1-73	E
Diesel fuel tank hatch cover	EN, MB, SSR	Aluminum	Air – outdoor	None	None	--	--	I, 503
ERP tower	SNS, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A3-12 (T-11)	3.5.1-25	A
Monorails	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A3-12 (T-11)	3.5.1-25	C
Roof decking	SRE	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A3-12 (T-11)	3.5.1-25	A

Table 3.5.2-3: Turbine Building, Process Facilities, and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Roof decking	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	III.A3-12 (T-11)	3.5.1-25	E
Structural steel: beams, columns, plates	EN, MB, SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A1-12 III.A3-12 (T-11)	3.5.1-25	A
Structural steel: beams, columns, plates	EN, MB, SRE, SNS, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A1-12 III.A3-12 (T-11)	3.5.1-25	A
Sump liners	SNS, SRE, SSR	Carbon steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Transmission tower	SRE	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B4-7 (TP-6)	3.5.1-50	C
Beams, columns, floor slabs and interior walls	EN, FB, MB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501
Diesel fuel tank retaining wall and slab	EN, MB, SSR	Concrete	Soil	None	Structures Monitoring	III.A3-2 (T-03)	3.5.1-27	I, 501
Diesel fuel tank retaining wall and slab	EN, MB, SSR	Concrete	Air – outdoor	None	Structures Monitoring	III.A3-2 (T-03)	3.5.1-27	I, 501

Table 3.5.2-3: Turbine Building, Process Facilities, and Yard Structures

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Duct banks	EN, SNS, SRE, SSR	Concrete	Soil	None	Structures Monitoring	III.A3-4 (T-05)	3.5.1-31	I, 501
Exterior walls	EN, FB, MB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501
Exterior walls	EN, FB, MB, PB, SNS, SRE, SSR	Concrete	Air – outdoor	None	Structures Monitoring Fire Protection	VII.G-30 (A-92)	3.3.1-66	I, 501
Exterior walls (below grade)	EN, FLB, MB, PB, SNS, SRE, SSR	Concrete	Soil	None	Structures Monitoring	III.A3-3 (T-08)	3.5.1-28	I, 501
Foundations	EN, SRE, SSR	Concrete	Soil	None	Structures Monitoring	III.A3-2 (T-03)	3.5.1-27	I, 501
Manholes	EN, SNS, SRE, SSR	Concrete	Soil	None	Structures Monitoring	III.A3-2 (T-03)	3.5.1-27	I, 501
Masonry walls (fire barriers)	EN, FB, SNS, SRE, SSR	Concrete block	Air – indoor uncontrolled	Cracking	Fire Protection	III.A1-11 III.A3-11 (T-12)	3.5.1-43	E

Table 3.5.2-3: Turbine Building, Process Facilities, and Yard Structures

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Masonry walls	EN, SNS, SRE, SSR	Concrete block	Air – indoor uncontrolled	Cracking	Masonry Wall	III.A1-11 III.A3-11 (T-12)	3.5.1-43	A
Masonry walls (fire barriers)	EN, FB, SNS, SRE, SSR	Concrete block	Air – outdoor	Cracking	Fire Protection	III.A1-11 III.A3-11 (T-12)	3.5.1-43	E
Masonry walls	EN, SNS, SRE, SSR	Concrete block	Air – outdoor	Cracking	Masonry Wall	III.A1-11 III.A3-11 (T-12)	3.5.1-43	A
Roof slabs	EN, FB, MB, PB, SNS, SRE, SSR	Concrete	Air – outdoor	None	Structures Monitoring Fire Protection	VII.G-30 (A-92)	3.3.1-66	I, 501
Roof slabs	EN, FB, MB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501
Sumps	SNS, SRE, SSR	Concrete	Exposed to fluid environment	None	Structures Monitoring	III.A3-2 (T-03)	3.5.1-27	I, 501
Sumps	SNS, SRE, SSR	Concrete	Soil	None	Structures Monitoring	III.A3-2 (T-03)	3.5.1-27	I, 501

Table 3.5.2-3: Turbine Building, Process Facilities, and Yard Structures

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Turbine shield wall	EN, MB, SNS	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A7-1 (T-03)	3.5.1-27	I, 501
Oil tank bunker crushed rock fill	EN	Crushed rock	Air – outdoor	Loss of form	Structures Monitoring	--	--	J
Oil tank bunker crushed rock fill	EN	Crushed rock	Soil	Loss of form	Structures Monitoring	--	--	J
Wooden utility poles	SRE	Treated wood	Air – outdoor	Loss of material Change in material properties	Structures Monitoring	--	--	J
Wooden utility poles	SRE	Treated wood	Soil	Loss of material Change in material properties	Structures Monitoring	--	--	J
Wooden utility towers	SRE	Treated wood	Air – outdoor	Loss of material Change in material properties	Structures Monitoring	--	--	J
Wooden utility towers	SRE	Treated wood	Soil	Loss of material Change in material properties	Structures Monitoring	--	--	J

Table 3.5.2-4
Bulk Commodities
Summary of Aging Management Evaluation

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Anchorage / embedments	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A
					ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B
Anchorage / embedments	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A
					ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Anchorage / embedments	SSR, SNS, SRE	Carbon steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
					Water Chemistry Control – BWR ISI-IWF	III.B1.1-11 (TP-10)	3.5.1-49	B
Anchorage / embedments	SSR, SNS, SRE	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR ISI-IWF	III.B1.1-11 (TP-10)	3.5.1-49	B
Base plates	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A
					ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Base plates	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A
					ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B
Base plates	SNS, SRE, SSR	Stainless steel	Air – outdoor	None	None	--	--	I, 503
Battery racks	SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B3-7 (T-30)	3.5.1-39	C
Cable tray	SSR, SNS, SRE	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 (T-30)	3.5.1-39	C
Cable tray	SSR, SNS, SRE	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2-5 (TP-11)	3.5.1-58	A
Cable trays support	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 (T-30)	3.5.1-39	A
Cable trays support	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2-5 (TP-11)	3.5.1-58	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Cardox hose reel	SRE	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	III.B2-10 (T-30)	3.5.1-39	E
Component and piping supports for ASME Class 1, 2, 3 and MC	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B
Component and piping supports for ASME Class 1, 2, 3 and MC	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B
Component and piping supports for ASME Class 1, 2, 3 and MC	SNS, SRE, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B1.1-9 III.B1.2-7 III.B1.3-7 (TP-5)	3.5.1-59	A
Component and piping supports	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Component and piping supports	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A
Component and piping supports	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2-7 III.B4-7 (TP-6)	3.5.1-50	A
Component and piping supports	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2-5 (TP-11)	3.5.1-58	A
Component and piping supports	SNS, SRE, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B2-8 III.B3-5 III.B4-8 III.B5-5 (TP-5)	3.5.1-59	A
Component and piping supports	SNS, SRE, SSR	Stainless steel	Air – outdoor	None	None			I, 503
Component and piping supports	SNS, SRE, SSR	Carbon steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Conduits	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2-5 (TP-11)	3.5.1-58	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Conduits	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2-7 (TP-6)	3.5.1-50	C
Conduit supports	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2-5 (TP-11)	3.5.1-58	A
Conduit supports	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2-7 (TP-6)	3.5.1-50	C
Conduit supports	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 (T-30)	3.5.1-39	A
Conduit supports	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2-10 (T-30)	3.5.1-39	A
Damper framing	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	III.B2-10 (T-30)	3.5.1-39	E
Electrical and instrument panels and enclosures	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B3-7 (T-30)	3.5.1-39	C
Electrical and instrument panels and enclosures	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.B3-7 (T-30)	3.5.1-39	C
Electrical and instrument panels and enclosures	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B3-3 (TP-11)	3.5.1-58	C

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Electrical and instrument panels and enclosures	SSR, SNS, SRE	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B4-7 (TP-6)	3.5.1-50	C
Fire doors	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	VII.G-3 (A-21)	3.3.1-63	B
Fire hose reels	SRE	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Water System	III.B2-10 (T-30)	3.5.1-39	E
Flood, pressure and specialty doors	EN, FLB, MB, PB	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A1-12 III.A2-12 III.A3-12 (T-11)	3.5.1-25	C
Flood, pressure and specialty doors	EN, FLB, MB, PB	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A1-12 III.A2-12 III.A3-12 (T-11)	3.5.1-25	C
HVAC duct supports	SNS, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 (T-30)	3.5.1-39	A
HVAC duct supports	SNS, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2-5 (TP-11)	3.5.1-58	A
Instrument line supports	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 (T-30)	3.5.1-39	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Instrument line supports	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2-5 (TP-11)	3.5.1-58	A
Instrument racks, frames and tubing trays	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B3-7 (T-30)	3.5.1-39	C
Instrument racks, frames and tubing trays	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2-5 (TP-11)	3.5.1-58	A
Manways, hatches, manhole covers, and hatch covers	EN, FLB, MB, PB, SRE, SSR, SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A1-12 III.A2-12 (T-11)	3.5.1-25	C
						III.A6-11 (T-21)	3.5.1-47	E
Manways, hatches, manhole covers, and hatch covers	EN, FLB, MB, PB, SRE, SSR, SNS	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A1-12 III.A3-12 (T-11)	3.5.1-25	C
						III.A6-11 (T-21)	3.5.1-47	E
Mirror insulation	INS, SNS	Stainless steel	Air – indoor uncontrolled	None	None	III.B1.3-7 (TP-5)	3.5.1-59	C, 502
Missile shields	EN, MB	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves (mechanical/ electrical not penetrating PC boundary)	FLB, SSR, SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 (T-30)	3.5.1-39	C
Pipe whip restraints	EN, SSR, SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	A
Stairway, handrail, platform, grating, decking, and ladders	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	A
Stairway, handrail, platform, grating, decking, and ladders	SNS	Galvanized steel	Air – indoor uncontrolled	None	None	III.B5-3 (TP-11)	3.5.1-58	A
Support members: welds, bolted connections, support anchorage to building structure	EN, SNS, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5-7 (T-30)	3.5.1-39	C
					ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Vents and louvers	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A1-12 III.A3-12 (T-11)	3.5.1-25	C
Vents and louvers	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A1-12 III.A3-12 (T-11)	3.5.1-25	C
Vents and louvers	SNS, SRE, SSR	Aluminum	Air – outdoor	None	None	--	--	I, 503
Anchor bolts	SNS, SRE, SSR	Carbon steel (bolted connections)	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B
Anchor bolts	SNS, SRE, SSR	Carbon steel (bolted connections)	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A
Anchor bolts	SSR, SNS, SRE	Carbon steel (bolted connections)	Air – outdoor	Loss of material	ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Anchor bolts	SSR, SNS, SRE	Carbon steel (bolted connections)	Air – outdoor	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A
Anchor bolts	SSR, SNS, SRE	Stainless steel (bolted connections)	Air – indoor uncontrolled	None	None	III.B2-8 III.B3-5 III.B4-8 III.B5-5 (TP-5)	3.5.1-59	A
Anchor bolts	SSR, SNS, SRE	Stainless steel (bolted connections)	Air – outdoor	None	None	--	--	I, 503
Anchor bolts	SSR, SNS, SRE	Galvanized steel (bolted connections)	Air – indoor uncontrolled	None	None	III.B2-5 III.B3-3 III.B4-5 III.B5-3 (TP-11)	3.5.1-58	A
Anchor bolts	SSR, SNS, SRE	Galvanized steel (bolted connections)	Air – outdoor	Loss of material	Structures Monitoring	III.B2-7 III.B4-7 (TP-6)	3.5.1-50	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
ASME Class 1, 2, 3 and MC supports bolting	SSR, SNS, SRE	Carbon steel (bolted connections)	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B
ASME Class 1, 2, 3 and MC supports bolting	SSR, SNS, SRE	Carbon steel (bolted connections)	Air – outdoor	Loss of material	ISI-IWF	III.B1.1-13 III.B1.2-10 III.B1.3-10 (T-24)	3.5.1-53	B
ASME Class 1, 2, 3 and MC supports bolting	SSR, SNS, SRE	Stainless steel (bolted connections)	Air – indoor uncontrolled	None	None	III.B2-8 III.B3-5 III.B4-8 III.B5-5 (TP-5)	3.5.1-59	A
ASME Class 1, 2, 3 and MC supports bolting	SSR, SNS, SRE	Stainless steel (bolted connections)	Air – outdoor	None	None	--	--	I, 503
Structural bolting	SNS, SRE, SSR	Carbon steel (bolted connections)	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Structural bolting	SNS, SRE, SSR	Carbon steel (bolted connections)	Air – outdoor	Loss of material	Structures Monitoring	III.B2-10 III.B3-7 III.B4-10 III.B5-7 (T-30)	3.5.1-39	A
Structural bolting	SNS, SRE, SSR	Carbon steel (bolted connections)	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A6-11 (T-21)	3.5.1-47	E
Structural bolting	SNS, SRE, SSR	Galvanized steel (bolted connections)	Air – indoor uncontrolled	None	None	III.B2-5 III.B3-3 III.B4-5 III.B5-3 (TP-11)	3.5.1-58	A
Structural bolting	SNS, SRE, SSR	Galvanized steel (bolted connections)	Air – outdoor	Loss of material	Structures Monitoring	III.B2-7 III.B4-7 (TP-6)	3.5.1-50	A
Structural bolting	SNS, SRE, SSR	Stainless steel (bolted connections)	Air – indoor uncontrolled	None	None	III.B2-8 III.B3-5 III.B4-8 III.B5-5 (TP-5)	3.5.1-59	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Structural bolting	SNS, SRE, SSR	Stainless steel (bolted connections)	Air – outdoor	None	None	--	--	I, 503
Equipment pads/ foundations	SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 III.A2-2 III.A3-2 III.A5-2 (T-03)	3.5.1-27	I, 501
Equipment pads/ foundations	SNS, SRE, SSR	Concrete	Air – outdoor	None	Structures Monitoring	III.A1-2 III.A2-2 III.A3-2 III.A5-2 III.A9-1 (T-03)	3.5.1-27	I, 501
Flood curbs	FLB, SNS, SRE	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	III.A3-2 III.A5-2 (T-03)	3.5.1-27	I, 501
Manways, hatches, manhole covers, and hatch covers	FB, FLB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring Fire Protection	VII.G-28 (A-90)	3.3.1-65	I, 501

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manways, hatches, manhole covers, and hatch covers	FB, FLB, PB, SNS, SRE, SSR	Concrete	Air – outdoor	None	Structures Monitoring Fire Protection	VII.G-30 (A-92)	3.3.1-66	I, 501
Missile shields	MB	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A7-1 III.A8-1 (T-03)	3.5.1-27	I, 501
Support pedestals	SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	None	Structures Monitoring	III.A1-2 III.A2-2 III.A3-2 III.A5-2 III.A9-1 (T-03)	3.5.1-27	I, 501
Support pedestals	SNS, SRE, SSR	Concrete	Air – outdoor	None	Structures Monitoring	III.A1-2 III.A2-2 III.A3-2 III.A5-2 III.A9-1 (T-03)	3.5.1-27	I, 501
Support pedestals	SNS, SRE, SSR	Concrete	Exposed to fluid environment	Loss of material	Structures Monitoring	III. A6-7 (T-20)	3.5.1-45	E

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fire stops	FB	Cera blanket, elastomers	Air – indoor uncontrolled	Cracking/ delamination Separation	Fire Protection	--	--	J
Fire wrap	FB	Cerafiber, cera blanket	Air – indoor uncontrolled	Loss of material	Fire Protection	--	--	J
Flood retention materials (spare parts)	FLB	Wood, sand bags, sealant	Air – indoor uncontrolled	None	Structures Monitoring	--	--	I, 501
Insulation	INS, SNS	Fiberglass/ calcium silicate	Air – indoor uncontrolled	None	None	--	--	J, 502
Penetration sealant (fire)	EN, FB, PB, SNS	Elastomer	Air – indoor uncontrolled	Cracking Change in material properties	Fire Protection	VII G-1 (A-19)	3.3.1-61	B
Penetration sealant (flood, radiation)	EN, FLB, PB, SNS	Elastomer	Air – indoor uncontrolled	Cracking Change in material properties	Structures Monitoring	III.A6-12 (TP-7)	3.5.1-44	C
Seals and gaskets (doors, manways and hatches)	FLB, PB, SSR	Elastomer	Air – indoor uncontrolled	Cracking Change in material properties	Structures Monitoring	II.B4-7 (C-18)	3.5.1-16	E

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Seals and gaskets (doors, manways and hatches)	FLB, PB, SSR	Elastomer	Air – indoor uncontrolled	Cracking Change in material properties	Structures Monitoring	III.A6-12 (TP-7)	3.5.1-44	A
Seismic isolation joint	FB, SSR	Elastomer	Air – indoor uncontrolled	Cracking Change in material properties	Fire Protection	VII.G-1 (A-19)	3.3.1-61	D
Seismic isolation joint	SSR	Elastomer	Air – indoor uncontrolled	Cracking Change in material properties	Structures Monitoring	III.A6-12 (TP-7)	3.5.1-44	C
Water stops	FLB	PVC	Air – indoor uncontrolled	None	None	--	--	J

3.6 ELECTRICAL AND INSTRUMENTATION AND CONTROLS

3.6.1 Introduction

This section provides the results of the aging management review for electrical components which are subject to aging management review. Consistent with the methods described in NEI 95-10, the EIC aging management reviews focus on commodity groups rather than systems. The following electrical commodity groups requiring aging management review are addressed in this section.

- high-voltage insulators
- non-EQ insulated cables and connections
  - cable connections (metallic parts)
  - electrical cables and connections not subject to 10CFR 50.49 EQ requirements
  - electrical cables not subject to 10CFR 50.49 EQ requirements used in instrumentation circuits
  - EIC penetration cables and connections not subject to 10 CFR 50.49 EQ requirements
  - fuse holders (insulation material)
  - inaccessible medium-voltage (2 kV to 35 kV) cables (e.g., installed underground in conduit, duct bank or direct buried) not subject to 10 CFR 50.49 EQ requirements
- metal-enclosed bus
  - metal enclosed bus (non-segregated bus for SBO recovery) – bus and connections
  - metal enclosed bus (non-segregated bus for SBO recovery) – insulation /insulators
  - metal enclosed bus – enclosure assemblies
- switchyard bus and connections
- transmission conductors and connections

Table 3.6.1, Summary of Aging Management Programs for Electrical Components Evaluated in Chapter VI of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the EIC components. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.6.2 Results

Table 3.6.2-1, EIC Components—Summary of Aging Management Evaluation, summarizes the results of aging management reviews and the NUREG-1801 comparison for EIC components.

3.6.2.1 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 EIC components subject to aging management review. Programs are described in Appendix B. Further details are provided in Table 3.6.2-1.

Materials

EIC components subject to aging management review are constructed of the following materials.

- aluminum
- cement
- copper and copper alloys
- elastomers
- galvanized metals
- insulation material – various organic polymers
- porcelain
- steel and steel alloys
- various metals used for electrical connections (stainless steel, brass, bronze, copper, aluminum)

Environment

EIC components subject to aging management review are exposed to the following environments.

- air – indoor
- air – outdoor
- heat and air
- moisture and air
- moisture and voltage stress
- radiation and air

Aging Effects Requiring Management

The following aging effects associated with EIC components require management.

- change in material properties
- loosening of bolted connections
- loss of material
- reduced insulation resistance

Aging Management Programs

The following aging management programs will manage the effects of aging on EIC components.

- Metal-Enclosed Bus Inspection
- Non-EQ Bolted Cable Connections
- Non-EQ Inaccessible Medium-Voltage Cable
- Non-EQ Instrumentation Circuits Test Review
- Non-EQ Insulated Cables and Connections

3.6.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation is necessary for certain aging effects and other issues. Section 3.6.2.2 of NUREG-1800 discusses these aging effects and other issues that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain the CNS approach to these areas requiring further evaluation. Programs are described in Appendix B of this application.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

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 Section 4.4. 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 Degradation of Insulator Quality due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material due to Mechanical Wear

The discussion in NUREG-1800 concerns effects of these aging mechanisms on high voltage insulators.

High voltage insulators are subject to aging management review if they are necessary for recovery of offsite power following an SBO. Other high voltage insulators are not subject to aging management review since they do not perform a license renewal intended function.

The high voltage insulators evaluated for CNS license renewal are those used to support uninsulated, high-voltage electrical components such as transmission conductors and switchyard buses that are in the scope of license renewal.

Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most areas washed away by rain. The glazed insulator surface aids this contamination removal.

A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the seacoast where salt spray is prevalent. CNS is not located near the seacoast or near other sources of airborne particles. Therefore, surface contamination is not an applicable aging effect for high-voltage insulators at CNS.

Mechanical wear is an aging effect for strain and suspension insulators subject to movement. Although this mechanism is possible, industry experience has shown transmission conductors do not normally swing and when subjected to a substantial wind, movement will subside after a short period. Wear has not been apparent during routine inspections and is not a credible aging effect.

There are no aging effects requiring management for CNS high-voltage insulators.

3.6.2.2.3 <u>Loss of Material due to Wind Induced Abrasion and Fatigue, Loss of Conductor Strength due to Corrosion, and Increased Resistance of Connection due to Oxidation or Loss of Pre-load</u>

Transmission conductors are uninsulated, stranded electrical cables used outside buildings in high voltage applications. The transmission conductor commodity group includes the associated fastening hardware but excludes the high-voltage insulators. Major active equipment assemblies include their associated transmission conductor terminations.

Transmission conductors are subject to aging management review if they are necessary for recovery of offsite power following an SBO. At CNS, transmission conductors from the 161 kV switchyard to the startup station service transformer (SSST) and from the 69 kV source to the emergency station service transformer (ESST) support recovery from an SBO. Other transmission conductors are not subject to aging management review since they do not perform a license renewal intended function.

Switchyard bus is uninsulated, un-enclosed, rigid electrical conductors used in medium- and high-voltage applications. Switchyard bus includes the hardware used to secure the bus to high-voltage insulators. Switchyard bus establishes electrical connections to disconnect switches, switchyard breakers, and transformers.

Switchyard bus is subject to aging management review if it is necessary for recovery of offsite power following an SBO. At CNS, switchyard bus from the 161 kV switchyard breakers to the transmission conductors and from the transmission conductors to the SSST support recovery from an SBO. At CNS, switchyard bus from the 69 kV switchyard breakers to the transmission conductors and from the transmission conductors to the ESST support recovery from an SBO. Other switchyard bus does not require aging management review since it does not perform a license renewal intended function.

Loss of Conductor Strength (Corrosion)

The most prevalent mechanism contributing to loss of conductor strength of an aluminum conductor steel reinforced (ACSR) transmission conductor is corrosion, which includes corrosion of the steel core and aluminum strand pitting. For ACSR conductors, degradation begins as a loss of zinc from the galvanized steel core wires.

Corrosion in ACSR conductors is a very slow-acting aging mechanism with the corrosion rates depending largely on air quality. Air quality factors include suspended particle chemistry, SO_2 concentration, and meteorological conditions. Air quality in rural areas, such as the area surrounding CNS, generally contains low concentrations of suspended particles and sulfur dioxide, which minimizes the corrosion rate. Tests performed by Ontario Hydro showed a 30% loss of composite conductor strength of an 80 year old ACSR conductor due to corrosion.

CNS SSST high-voltage side is connected to the 161 kV switchyard via overhead transmission lines. The 161 kV overhead transmission conductors are 886.4 thousand circular mils (MCM) 26/4 ACSR. This specific conductor type was not included in the Ontario Hydro test, but the types that were included are representative of the CNS 161 kV conductors. CNS ESST high-voltage side is connected to the 69 kV switchyard via overhead transmission lines. Two sections of the 69 kV overhead transmission conductors are 4/0 American wire gauge (AWG) 6/1 ACSR, and the third section is 397.5 MCM 26/7 ACSR. The 4/0 ACSR transmission conductor tested in the Ontario Hydro test, as documented in the companion paper, "Aged ACSR Conductors, Part II - Prediction of Remaining Life," bounds the CNS transmission conductors.

There is a percentage of composite conductor strength established at which a transmission conductor is replaced. As illustrated below, there is ample strength margin to maintain the transmission conductor intended function through the period of extended operation.

The National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60% of the ultimate conductor strength. The NESC also specifies the maximum tension a conductor must be designed to withstand under heavy load requirements, which includes consideration of ice, wind and temperature. These requirements are reviewed for the specific transmission conductors included in the scope of license renewal. Evaluation of the conductor type with the smallest ultimate strength margin (4/0 ACSR) in the NESC illustrates the conservative nature of the design of transmission conductors.

The ultimate strength and the NESC heavy load tension requirements of 4/0 ACSR (212 MCM) are 8350 lbs. and 2761 lbs. respectively. The margin between the NESC heavy load and the ultimate strength is 5589 lb.; i.e., there is a 67% of ultimate strength margin. The Ontario Hydro study showed a 30% loss of composite conductor strength in an 80-year-old conductor. In the case of the 4/0 ACSR transmission conductors, a 30% loss of ultimate strength would mean that there would still be a 37% ultimate strength margin between what is required by the NESC and the actual conductor strength after 80 years of service.

The 4/0 ACSR conductor type has the lowest initial design margin of in-scope CNS transmission conductors. This illustrates with reasonable assurance that transmission conductors will have ample strength through the period of extended operation.

There are no applicable aging effects that could cause loss of the intended function of the transmission conductors for the period of extended operation.

A review of industry OE and NRC generic communications related to the aging of transmission conductors ensured that no additional aging effects exist beyond those previously identified. A review of plant-specific OE did not identify any unique aging effects for transmission conductors at CNS.

Loss of Material (Wear)

Wind loading can cause transmission conductor vibration, or sway. Wind loading that can cause a transmission line and insulators to vibrate is considered in the design and installation. Loss of material (wear) and fatigue that could be caused by transmission conductor vibration or sway are not applicable aging effects in that they would not cause a loss of intended function if left unmanaged for the period of extended operation.

Operation of active switchyard components is also a potential contributor to vibration and resulting wear. Switchyard bus is connected to active equipment by short sections of flexible conductors. The flexible conductors are part of the switchyard bus commodity group. Vibration is not applicable since flexible conductors connecting switchyard bus to active components eliminate potential for vibration.

A review of industry OE and NRC generic communications related to the aging of transmission conductors ensured that no additional aging effects exist beyond those previously identified. A review of plant-specific OE did not identify any unique aging effects for transmission conductors.

Therefore, loss of material due to wear of switchyard bus is not an aging effect requiring management at CNS.

Increased Connection Resistance (Corrosion)

Corrosion due to surface oxidation for welded aluminum switchyard bus and connections is not applicable. However, the flexible conductors, which are welded to the switchyard bus, are bolted to the other switchyard components.

Increased connection resistance due to surface oxidation is a potential aging effect, but is not significant enough to cause a loss of intended function. The components in the switchyard are exposed to precipitation, but these components do not experience aging effects in this environment, except for minor oxidation, which does not impact the ability of the connections to perform their intended function. At CNS, switchyard connection surfaces are coated with an anti-oxidant compound (i.e., a grease-type sealant) prior to tightening the connection to prevent the formation of oxides on the metal surface and to prevent moisture from entering the connections thus minimizing the potential for corrosion. Based on operating experience, (CNS and the industry), this method of installation provides a corrosion-resistant low electrical resistance connection. This discussion is applicable for bolted connections of transmission conductors and switchyard bus.

These switchyard component connections are included in the infrared inspection of the 161 kV switchyard connections, which verifies the effectiveness of the connection design and installation practices. CNS performs infrared inspection of the 161 kV switchyard connections and transformer yard connections as part of a periodic preventive maintenance (PM) task to verify the integrity of the connections. This inspection and plant-specific OE verifies that this aging effect is not significant for CNS.

Therefore, increased connection resistance due to general corrosion resulting from oxidation of switchyard connection surface metals is not an aging effect requiring management at CNS.

Increased Connection Resistance (Loss of Preload)

Increased connection resistance due to loss of pre-load (torque relaxation) for switchyard connections is not an aging effect requiring management. The EPRI license renewal tools do not list loss of pre-load as an applicable aging mechanism. The design of the transmission conductor and switchyard bus bolted connections precludes torque relaxation as confirmed by plant specific OE. The CNS OE report did not identify any failures of switchyard connections. The design of switchyard bolted connections includes Bellville washers and an antioxidant compound (i.e., a grease-type sealant). The type of bolting plate and the use of Bellville washers is the industry standard to preclude torque relaxation. This combined with the proper sizing of the conductors eliminates this aging mechanism; therefore, increased connection resistance due to loss of pre-load on switchyard connections is not an aging effect requiring management. This discussion is applicable for bolted connections of transmission conductors and switchyard bus.

CNS performs infrared inspection of the 161 kV switchyard connections and the transformer yard as part of a periodic PM task to verify the integrity of the connections. Routine inspections of the 69 kV transmission conductors, including infrared inspections at the 69 kV switchyard and transformer yard are performed. These routine inspections, as confirmed by plant-specific OE, confirm that this aging effect is not significant for CNS.

Based on this information, increased connection resistance due to loss of pre-load of transmission conductor and switchyard bus connections is not an aging effect requiring management for CNS.

There are no aging effects requiring management for CNS transmission conductors and switchyard bus connections.

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of CNS quality assurance procedures and administrative controls for aging management programs.

3.6.2.3 Time-Limited Aging Analysis

The only TLAAs identified for the EIC commodity components are evaluations for environmental qualification (EQ). The EQ TLAA is evaluated in Section 4.4.

3.6.3 Conclusion

EIC components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1). Aging management programs selected to manage aging effects for the EIC components are identified in Section 3.6.2.1 and in the following tables. A description of 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.

Based on the demonstrations provided in Appendix B, the effects of aging associated with EIC components will be managed such that there is reasonable assurance the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.6.1
Summary of Aging Management Programs for the EIC Components Evaluated in Chapter VI of NUREG-1801

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1					
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 environmental qualification (EQ) requirements	Degradation due to various aging mechanisms	Environmental Qualification of Electric Components	Yes, TLAA	EQ equipment is not subject to aging management review because the equipment is subject to replacement based on a qualified life. EQ analyses are evaluated as potential TLAAs in Section 4.4. See Section 3.6.2.2.1
3.6.1-2	Electrical cables, connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements	Reduced insulation resistance (IR) and electrical failure due to various physical, thermal, radiolytic, photolytic and chemical mechanisms	Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements	No	Consistent with NUREG-1801. The Non-EQ Insulated Cables and Connections Program will manage the effects of aging. This program includes inspection of non-EQ EIC penetration cables and connections. CNS EQ EIC penetration assemblies are covered under the EQ Program.

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-3	Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (IR)	Reduced insulation resistance (IR) and electrical failure due to various physical, thermal, radiolytic, photolytic and chemical mechanisms	Electrical Cables and Connections Used in Instrumentation Circuits Not Subject to 10 CFR 50.49 EQ Requirements	No	Consistent with NUREG-1801. The Non-EQ Instrumentation Circuits Test Review Program will manage the effects of aging. This program includes review of calibration results or surveillance findings for instrumentation circuits.
3.6.1-4	Conductor insulation for inaccessible medium-voltage (2kV to 35kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water trees	Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements	No	Consistent with NUREG-1801. The Non-EQ Inaccessible Medium-Voltage Cable Program will manage the effects of aging. Includes inspection and testing of medium-voltage cables exposed to significant moisture and voltage as required. In Table 3.6.2-1, reduced insulation resistance is considered equivalent to the aging effect listed for this item (breakdown of insulation).
3.6.1-5	PWR only				

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-6	Fuse holders (not part of a larger assembly) - metallic clamp	Fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation	Fuse Holders	No	NUREG-1801 aging effects are not applicable to CNS. A review of CNS documents indicated that fuse holders utilizing metallic clamps are either part of an active device or located in circuits that perform no intended function. Therefore, fuse holders with metallic clamps at CNS are not subject to aging management review.
3.6.1-7	Metal enclosed bus – bus / connections	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus	No	Consistent with NUREG-1801. The Metal-Enclosed Bus Inspection Program will manage the effects of aging. This program includes visual inspection of interior portions of the bus.
3.6.1-8	Metal enclosed bus – insulation / insulators	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Metal Enclosed Bus	No	Consistent with NUREG-1801. The Metal-Enclosed Bus Inspection Program will manage the effects of aging. This program includes visual inspection of interior portions of the bus.
3.6.1-9	Metal enclosed bus – enclosure assemblies	Loss of material due to general corrosion	Structures Monitoring Program	No	Not consistent with NUREG-1801. The Metal-Enclosed Bus Inspection Program will manage the effects of aging through visual inspection.

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-10	Metal enclosed bus – enclosure assemblies	Hardening and loss of strength / elastomers degradation	Structures Monitoring Program	No	Not consistent with NUREG-1801. The Metal-Enclosed Bus Inspection Program will manage the effects of aging through visual inspection for cracking and flexing of the elastomers for flexibility. In Table 3.6.2-1, change in material properties is considered equivalent to the aging effect listed for this item (hardening and loss of strength).
3.6.1-11	High voltage insulators	Degradation of insulation quality due to presence of any salt deposits and surface contamination; loss of material caused by mechanical wear due to wind blowing on transmission conductors	Plant specific	Yes, plant specific	NUREG-1801 aging effects are not applicable to CNS. See Section 3.6.2.2.2.
3.6.1-12	Transmission conductors and connections; switchyard bus and connections	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload	Plant specific	Yes, plant specific	NUREG-1801 aging effects are not applicable to CNS. See Section 3.6.2.2.3.

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-13	Cable connections metallic parts	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	No	Not consistent with NUREG-1801. CNS is providing a plant-specific one-time inspection program (Non-EQ Bolted Cable Connections Program) as an alternate to the NUREG-1801, XI.E6 program. This one-time inspection program will verify the absence of aging effects requiring management.
3.6.1-14	Fuse holders (not part of a larger assembly) – insulation material	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.

Notes for Tables 3.6.2-1

Generic notes

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program 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 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes

601. Based on the NEI/NRC meeting on November 30, 2006, to discuss the NUREG-1801, XI.E6 program, CNS will implement a one-time inspection program prior to the period of extended operation to verify the absence of aging effects requiring management. Further guidance was provided in the proposed LR-ISG-2007-02.

602. The Metal-Enclosed Bus Inspection Program was enhanced to include the aging management program for these aging effects instead of using the Structures Monitoring Program.

Table 3.6.2-1
Electrical Components
Summary of Aging Management

Table 3.6.2-1 Electrical Components								
Component Type	**Component Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Cable connections (metallic parts)	CE	Various metals used for electrical connections	Air – indoor	Loosening of bolted connections	Non-EQ Bolted Cable Connections	VI.A-1 (LP-12)	3.6.1-13	E, 601
Electrical cables and connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements (includes non-EQ EIC penetration conductors and connections)	CE	Insulation material – various organic polymers	Heat, moisture, or radiation and air	Reduced insulation resistance	Non-EQ Insulated Cables and Connections	VI.A-2 (L-01) VI.A-6 (LP-03)	3.6.1-2	A
Electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits	CE	Insulation material – various organic polymers	Heat, moisture, or radiation and air	Reduced insulation resistance	Non-EQ Instrumentation Circuits Test Review	VI.A-3 (L-02)	3.6.1-3	A

Table 3.6.2-1 Electrical Components (Continued)

Component Type	Component Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fuse holders (insulation material)	CE	Insulation material – various organic polymers	Air – indoor	None	None	VI.A-7 (LP-02)	3.6.1-14	A
High voltage insulators (high voltage insulators for SBO recovery)	IN	Porcelain, galvanized metals, cement	Air – outdoor	None	None	VI.A-10 (LP-11)	3.6.1-11	I
Inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	CE	Insulation material – various organic polymers	Moisture and voltage stress	Reduced insulation resistance	Non-EQ Inaccessible Medium-Voltage Cable	VI.A-4 (L-03)	3.6.1-4	A
Metal enclosed bus (non-segregated bus for SBO recovery) • bus and connections	CE	Aluminum, copper, steel, steel alloy	Air – indoor Air – outdoor	Loosening of bolted connections	Metal-Enclosed Bus Inspection	VI.A-11 (LP-04)	3.6.1-7	B
Metal enclosed bus (non-segregated bus for SBO recovery) • insulation / insulators	IN	Porcelain, galvanized metals	Air – indoor Air – outdoor	Reduced insulation resistance	Metal-Enclosed Bus Inspection	VI.A-14 (LP-05)	3.6.1-8	B

Table 3.6.2-1 Electrical Components (Continued)

Component Type	Component Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Metal enclosed bus (non-segregated bus for SBO recovery) • enclosure assemblies	SRE	Aluminum, steel, steel alloy	Air – indoor Air – outdoor	Loss of material	Metal-Enclosed Bus Inspection	VI.A-13 (LP-06)	3.6.1-9	E, 602
Metal enclosed bus (non-segregated bus for SBO recovery) • enclosure assemblies	SRE	Elastomers	Air – indoor Air – outdoor	Change in material properties	Metal-Enclosed Bus Inspection	VI.A-12 (LP-10)	3.6.1-10	E, 602
Switchyard bus (switchyard bus for SBO recovery) • connections	CE	Aluminum, steel, steel alloy	Air – outdoor	None	None	VI.A-15 (LP-9)	3.6.1-12	I
Transmission conductors (transmission conductors for SBO recovery) • connections	CE	Aluminum, steel, steel alloy	Air – outdoor	None	None	VI.A-16 (LP-08)	3.6.1-12	I

4.0 TIME-LIMITED AGING ANALYSES

4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

Time-limited aging analyses are defined in 10 CFR 54.3.

> *Time-limited aging analyses*, for the purposes of this part, are those licensee calculations and analyses that:
>
> (1) Involve systems, structures, and components within the scope of license renewal, as delineated in §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 to be relevant by the licensee 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 functions, as delineated in §54.4(b); and
>
> (6) Are contained or incorporated by reference in the CLB.

Section 10 CFR 54.21(c) requires a list of time-limited aging analyses (TLAA) as part of the application for a renewed license. Section 10 CFR 54.21(c)(2) requires a list of current exemptions to 10 CFR 50 based on TLAA 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.

4.1.1 Identification of TLAA

The process used to identify the time-limited aging analyses is consistent with the guidance provided in NEI 95-10, *Industry Guidelines for Implementing the Requirements of 10 CFR 54 – The License Renewal Rule*, Revision 6, June 2005. Calculations and analyses that potentially meet the definition of 10 CFR 54.3 were identified by searching current licensing basis (CLB) documents including the following.

- Updated Safety Analysis Report (USAR)
  - Plant Unique Analysis Report (PUAR), referenced in the USAR
- Technical Specifications and Bases
- Technical Requirements Manual
- General Electric (GE) topical reports referenced in the USAR and in docketed licensing correspondences
- Fire Protection Program documents
  - Fire Hazards Analysis
  - Safe Shutdown Analysis
- Inservice Inspection Program
- NRC safety evaluation reports
- Docketed licensing correspondence

Industry documents that list generic time-limited aging analyses were also reviewed to provide additional assurance of the completeness of the plant-specific list. These documents included NEI 95-10; NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 1, September 2005; NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 1, September 2005; EPRI Report TR-105090, *Guidelines to Implement the License Renewal Technical Requirements of 10 CFR 54 for Integrated Plant Assessments and Time-Limited Aging Analyses*, November 1995; and NRC safety evaluation reports related to license renewal applications by other BWR licensees.

Table 4.1-1 provides a summary listing of the TLAAs.

4.1.2 Identification of Exemptions

Exemptions for CNS were identified through a review of the USAR, fire protection documents, the operating license, the Technical Specifications, and docketed correspondence. There are no exemptions that remain in effect for CNS based on time-limited aging analyses.

Table 4.1-1
List of CNS TLAA and Resolution

TLAA Description	Resolution Option	Section
Reactor Vessel Neutron Embrittlement Analyses		4.2
Adjusted reference temperature	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.2.2
Pressure/temperature limits	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.2.3
Upper-shelf energy	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.2.4
Reactor vessel circumferential weld inspection relief	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.2.5
Metal Fatigue Analyses		4.3
Reactor vessel	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.1
Reactor vessel feedwater nozzle	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.2
Reactor vessel internals—core plate plugs	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.3.1
Class 1 piping—B31.1 piping	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.3.1.4.1
Class 1 piping—ASME Section III piping	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.4.2
Fatigue analyses of non-Class 1 components	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.3.2
Effects of reactor water environment on fatigue life	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.3
Environmental Qualification Analyses of Electrical Equipment	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.4
Concrete Containment Tendon Prestress Analyses	Not applicable for CNS	4.5

Table 4.1-1
List of CNS TLAA and Resolution (Continued)

TLAA Description	Resolution Option	Section
Containment Liner Plate, Metal Containment, and Penetrations Fatigue Analyses		4.6
Torus shell and supports—torus shell	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.6.1.1
Torus shell and supports—torus support system	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.6.1.2
Torus shell and supports—ring girder	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.6.1.3
Torus shell and supports—shell penetrations and attachments	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.6.1.4
Torus vent system—main vent intersection with vent header	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.6.2.1
Torus vent system—vent header miter joint	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.6.2.2
Torus vent system—main vent bellows	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.6.2.3
Torus vent system—main vent safety/relief valve discharge line (S/RVDL) penetrations	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.6.2.4
Torus vent system—downcomer and tiebars	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.6.2.5
Safety/relief valve discharge lines	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.6.3
Torus attached piping	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.6.4
Torus piping penetrations	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.6.5
Other Plant-Specific TLAA		4.7
Core plate plugs	Aging effect managed 10 CFR 54.21(c)(1)(iii)	4.7.1

Table 4.1-1
List of CNS TLAA and Resolution (Continued)

TLAA Description	Resolution Option	Section
TLAA in BWRVIP Documents		4.7.2
BWRVIP-74-A, reactor pressure vessel • Pressure/temperature curve analyses • Fatigue • • Equivalent margin analysis • Exempting reactor pressure vessel circumferential welds from inspection	 Aging effect managed 10 CFR 54.21(c)(1)(iii) Aging effect managed 10 CFR 54.21(c)(1)(iii) Analysis projected 10 CFR 54.21(c)(1)(ii) Analysis projected 10 CFR 54.21(c)(1)(ii)	4.7.2.1

4.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT

The regulations governing reactor vessel integrity are in 10 CFR 50. Section 50.60 requires that all light-water reactors meet the fracture toughness, pressure-temperature limits, and material surveillance program requirements for the reactor coolant pressure boundary as set forth in Appendices G and H of 10 CFR 50.

For Cycle 25 and beyond, NPPD requested NRC approval an Appendix K measurement uncertainty recapture (MUR) power uprate to increase the licensed reactor core power level by 1.62 percent to 2419 MWt. The MUR bounding power level with measurement uncertainty is 2429 MWt (102 percent of 2381 MWt) (Reference 4.2-1).

The CNS current licensing basis analyses evaluating reduction of fracture toughness of the reactor vessel for 40 years are TLAA. The reactor vessel neutron embrittlement TLAA, including consideration for the MUR, have either been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) or will be managed for the period of extended operation in accordance with 10 CFR 54.24(c)(1)(iii) as summarized below.

Based on the plant operating history and assuming 100 percent capacity factor through the period of extended operation, CNS will not surpass 50 effective full power years (EFPY). However, 54 EFPY (90 percent capacity factor times 60 years) is conservatively used as the end of the period of extended operation to evaluate reactor vessel neutron embrittlement TLAA.

4.2.1 <u>Reactor Vessel Fluence</u>

Calculated fluence is based on a time-limited assumption defined by the operating term. Therefore, analyses that evaluate reactor vessel neutron embrittlement based on calculated fluence are time-limited aging analyses.

The high energy (> 1 MeV) neutron fluence for the welds and shells of the reactor pressure vessel beltline region was determined using the Radiation Analysis Modeling Application (RAMA) fluence method, which adheres to the guidance prescribed in RG 1.190. The NRC staff has approved the use of the RAMA fluence code at CNS (Reference 4.2-12). The following peak fluence values at 54 EFPY are used throughout the remainder of Section 4.2.

Table 4.2-1
Peak Fluence Values at 54 EFPY

Location	Internal Surface (0T) Fluence, n/cm^2 (*)	1/4 T(**) Fluence, n/cm^2
Lower shell	1.48E+18	1.01E+18
Lower intermediate shell	1.95E+18	1.41E+18
Lower shell axial weld #1	9.19E+17	6.27E+17
Lower shell axial weld #2	1.46E+18	9.96E+17
Lower shell axial weld #3	9.79E+17	6.68E+17
Lower intermediate shell axial weld #1 and #3	1.00E+18	7.24E+17
Lower intermediate shell axial weld #2	1.21E+18	8.76E+17
Lower shell to lower intermediate shell circumferential welds	1.48E+18	1.07E+18

*neutrons per square centimeter
**one-fourth of the way through the vessel wall measured from the internal surface of the vessel

The beltline for 40 years consists of three lower shell plates, three lower-intermediate shell plates, six axial welds, and one circumferential weld all adjacent to the active fuel zone. There are no ferritic nozzles in the beltline region for the current term of operation.

The beltline has been re-evaluated for 60 years based on the axial flux profile and the active fuel and nozzle elevations. Fluence at the recirculation inlet nozzles (the closest ferritic nozzles to the beltline) will not exceed 1E+17 n/cm^2 during the period of extended operation. The plates and welds in the beltline remain the limiting materials for the period of extended operation.

4.2.2 Adjusted Reference Temperatures

The nil-ductility transition temperature and reference temperature of nil-ductility transition (RT_{NDT}) values for the reactor vessel increase as a function of integrated neutron exposure. Irradiation by high-energy neutrons raises the value of RT_{NDT} for the reactor vessel. As defined by RG 1.99, Revision 2, adjusted reference temperature (ART) is defined as initial RT_{NDT} + ΔRT_{NDT} + margin. Pressure and temperature limits are developed from ART values for reactor vessel materials.

The ΔRT_{NDT} and ART values were projected to 54 EFPY using the methods described in RG 1.99, Revision 2. Credible CNS surveillance data and the integrated surveillance program (ISP) were used to determine chemistry factors (CF) and best estimate chemistry values for lower intermediate shell plates G2802-1 and G2802-2. Updated estimates of the copper (Cu) and nickel (Ni) chemistry values and corresponding CF were also used for lower to lower intermediate shell circumferential weld 1-240. ART calculation inputs are consistent with RVID2 (Reference 4.2-5), except as noted in Table 4.2-2.

New fluence factors (FFs) were calculated using RG 1.99, Revision 2, Equation 2 and ¼T 54 EFPY fluence values listed in Table 4.2-1. The projected ΔRT_{NDT} values were calculated by multiplying the CF and the FF for each plate and weld. The initial RT_{NDT}, the calculated ΔRT_{NDT}, and the calculated margins were then added to determine ART.

All projected values for ART are well below the 200°F suggested in Section 3 of RG 1.99 as an acceptable value of ART for the end of the period of extended operation. The TLAA for adjusted reference temperature is thus projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Table 4.2-2
CNS Adjusted Reference Temperature Data for 54 Effective Full-Power Years

Material Identification			Fluence				Chemistry			54 EFPY Projection					
Beltline Region	Code No.	Heat No.	Wall Thick-ness (in.)	0 T Fluence (10^{18} n/cm^2)	¼ T Fluence (10^{18} n/cm^2)	¼ T Fluence Factor	Cu (wt %)	Ni (wt %)	Chemistry Factor (°F)	Initial RT_{NDT} (°F)	ΔRT_{NDT} (°F)	σ_I (°F)	σ_Δ (°F)	Margin (°F)	ART (°F)
Lower shell #1	G2803-1	C2274-1	6.375	1.48	1.01	0.419	0.200	0.680	153.00	14	64.1	0.0	17.0	34.0	112.1
Lower shell #2	G2803-2	C2307-1	6.375	1.48	1.01	0.419	0.210	0.730	162.80	0	68.2	0.0	17.0	34.0	102.2
Lower shell #3	G2803-3	C2274-2	6.375	1.48	1.01	0.419	0.200	0.680	153.00	-8	64.1	0.0	17.0	34.0	90.1
Lower intermediate shell #1	G2801-7	C2407-1	5.375	1.95	1.41	0.489	0.130	0.650	92.25	-10	45.2	0.0	17.0	34.0	69.2
Lower intermediate shell #2	G2802-1	C2331-2	5.375	1.95	1.41	0.489	0.160(1)	0.620(1)	149.50(1)	10	73.2	0.0	8.5(2)	17.0	100.2
Lower intermediate shell #3	G2802-2	C2307-2	5.375	1.95	1.41	0.489	0.210	0.760(1)	258.34(1)	-20	126.5	0.0	8.5(2)	17.0	123.5
Lower intermediate shell axial welds #1 and #3	1-233-A and C	27204/ 12008	5.375	1.00	0.724	0.355	0.219	0.996	231.06	-50	82.1	0.0	28.0	56.0	88.1
Lower intermediate shell axial weld #2	1-233-B	27204/ 12008	5.375	1.21	0.876	0.391	0.219	0.996	231.06	-50	90.3	0.0	28.0	56.0	96.3

Table 4.2-2 (Continued)
CNS Adjusted Reference Temperature Data for 54 Effective Full-Power Years

Material Identification			Fluence				Chemistry			54 EFPY Projection					
Beltline Region	Code No.	Heat No.	Wall Thick-ness (in.)	0 T Fluence (10^{18} n/cm^2)	¼ T Fluence (10^{18} n/cm^2)	¼ T Fluence Factor	Cu (wt %)	Ni (wt %)	Chemistry Factor (°F)	Initial RT_{NDT} (°F)	ΔRT_{NDT} (°F)	σ_I (°F)	σ_Δ (°F)	Margin (°F)	ART (°F)
Lower shell axial weld #1	2-233-A	12420	6.375	0.919	0.627	0.330	0.270	1.035	254.43	-50	84.0	0.0	28.0	56.0	90.0
Lower shell axial weld #2	2-233-B	12420	6.375	1.46	0.996	0.416	0.270	1.035	254.43	-50	105.9	0.0	28.0	56.0	111.9
Lower shell axial weld #3	2-233-C	12420	6.375	0.979	0.668	0.341	0.270	1.035	254.43	-50	86.8	0.0	28.0	56.0	92.8
Lower to lower intermediate shell circumferential weld	1-240	21935	5.375	1.48	1.07	0.431	0.183 (1)	0.704 (1)	172.22 (1)	-50	74.2	0.0	28.0	56.0	80.2

1. BWRVIP-135, Revision 1 (Reference 4.2-6).
2. Margin value (σ_Δ) of half the RG 1.99 value, or 8.5ºF, used for base metal having credible surveillance data in the ISP.

4.2.3 Pressure-Temperature Limits

Appendix G of 10 CFR 50 requires that the reactor vessel remain within established pressure-temperature (P-T) limits during boltup, hydro-test, pressure tests, normal operation, and anticipated operational occurrences. These limits are calculated using materials and fluence data, including data obtained through the Reactor Vessel Surveillance Program.

Technical Specifications (Reference 4.2-2) contain P-T limits valid through 28 EFPY including the effects of the MUR.

Additional P-T limit analysis is not required at this time, but P-T limit curves will continue to be updated, as required by Appendix G of 10 CFR Part 50, assuring that operational limits remain valid through the period of extended operation.

Therefore, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation consistent with 10 CFR 54.21(c)(1)(iii).

4.2.4 Upper Shelf Energy (USE)

Appendix G of 10 CFR 50 requires that reactor vessel beltline materials "...have Charpy upper shelf energy…of no less than 75 ft-lb initially and must maintain Charpy upper shelf energy throughout the life of the vessel of no less than 50 ft-lb." These bounding limits are addressed using the methodology defined by BWRVIP-74-A. RG 1.99 defines the method for predicting USE drop in terms of a percentage from the unirradiated value. Charpy upper shelf energy (C_VUSE) values were projected to 54 EFPY, including the effects of the MUR.

RG 1.99 provides two methods (positions) for determining C_VUSE. Position 1 applies for material that does not have surveillance data available, and Position 2 applies for material that does have surveillance data. For Position 1, the percent drop in C_VUSE for a stated copper content and neutron fluence is determined by reference to Figure 2 of RG 1.99 in accordance with RG 1.99 Section 1.2. This percentage drop is applied to the initial C_VUSE to obtain the adjusted C_VUSE. For Position 2, the percent drop in C_VUSE is determined by plotting the available data on Figure 2 and fitting the data with a line drawn parallel to the existing lines that bound all the plotted points in accordance with RG 1.99 Section 2.2.

The upper shelf energy (USE) values were determined based on the maximum projected 54 EFPY beltline fluence values shown in Table 4.2-1. The beltline region chemistry and surveillance data, including the un-irradiated C_VUSE information, is from the RVID2 database and clarified in GE-NE-523-159-1292 (Reference 4.2-4) and BWRVIP-135 (Reference 4.2-6). The predicted C_VUSE values based on the RG 1.99 Position 1 method are shown in Table 4.2-5 for each of the CNS beltline materials. All projected USE values in Table 4.2-5 for 54 EFPY are no less than 50 ft-lbs, so the equivalent margin analysis (EMA) per BWRVIP-74-A is not required for these materials.

For all welds, the initial USE (unirradiated C_VUSE) values are not actual USE but the highest Charpy energy from tests done at 10°F, a conservative estimate per GE-NE-523-159-1292 (Reference 4.2-4). In addition, an EMA was conservatively performed for welds 1-240, 2-233-A, 2-233-B, and 2-233-C, since RVID2 identifies an EMA was previously performed for these welds. The EMA results for weld 1-240 for 54 EFPY are shown in Table 4.2-3. For welds 2-233-A, 2-233-B, and 2-233-C, a single EMA was performed that represents all three welds and is shown in Table 4.2-4. In all cases, USE reductions for the CNS materials are less than the limiting reduction in BWRVIP-74-A (Reference 4.2-3), thereby demonstrating acceptability for 54 EFPY and further substantiating the results shown in Table 4.2-5.

Therefore, the TLAA associated with C_VUSE have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Table 4.2-3
CNS Equivalent Margin Analysis for Lower-Intermediate Circumferential Weld (1-240) for 54 EFPY

BWR/2-6 Weld (Lower-intermediate to lower shell girth weld, Code No. 1-240, Heat No. 21935)

Surveillance Weld USE: 300º Capsule	
% Cu	0.23
Capsule Fluence (n/cm^2)	2.8E+17
Measured Decrease (%)	20.0
RG 1.99 Predicted Decrease (%)	16.5
Surveillance Weld USE: 30º Capsule	
% Cu	0.23
Capsule Fluence (n/cm^2)	2.4E+17
Measured Decrease (%)	22.0
RG 1.99 Predicted Decrease (%)	15.5
Limiting Beltline Weld USE	
% Cu	0.183
54 EFPY Peak ID Fluence (n/cm^2)	1.48E+18
54 EFPY 1/4 T Fluence (n/cm^2)	1.07E+17
RG 1.99 Predicted Decrease (%)	19.4
Adjusted % Decrease (%)	N/A

Maximum = 19.4% (predicted) < 22% (measured) < 39%,
therefore welds are bounded by equivalent margins analysis.

Table 4.2-4
CNS Equivalent Margin Analysis for Lower Axial Welds (2-233-A, -B, -C) for 54 EFPY

BWR/2-6 Weld (Lower shell longitudinal welds #1, #2, #3, Code No. 2-233-A, -B, -C, Heat No. 12420)

Surveillance Weld USE: 300º Capsule	
% Cu	0.23
Capsule Fluence (n/cm^2)	2.8E+17
Measured Decrease (%)	20.0
RG 1.99 Predicted Decrease (%)	16.5
Surveillance Weld USE: 30º Capsule	
% Cu	0.23
Capsule Fluence (n/cm^2)	2.4E+17
Measured Decrease (%)	22.0
RG 1.99 Predicted Decrease (%)	15.5
Limiting Beltline Weld USE	
% Cu	0.27
54 EFPY Peak ID Fluence (n/cm^2)	1.46E+18
54 EFPY 1/4 T Fluence (n/cm^2)	9.96E+17
RG 1.99 Predicted Decrease (%)	24.3
Adjusted % Decrease (%)	N/A

Maximum = 24.3% (predicted) < 39%,
therefore welds are bounded by equivalent margins analysis.

Table 4.2-5
CNS Upper Shelf Energy Data for 54 Effective Full-Power Years

Material Description						54 EFPY Projection		
Beltline Region	**Code No.**	**Heat No.**	**Flux Type**	**Cu (wt %)**	**Unirradiated C_VUSE (ft-lbs)[1]**	**¼T Fluence (n/cm^2)**	**Drop in C_VUSE (%**	**¼T C_VUSE (ft-lbs)**
Lower shell #1	G2803-1	C2274-1	--	0.200	72.8	1.01E+18	17.0	60.4
Lower shell #2	G2803-2	C2307-1	--	0.210	74.8	1.01E+18	17.7	61.6
Lower shell #3	G2803-3	C2274-2	--	0.200	72.2	1.01E+18	17.0	59.9
Lower intermediate shell #1	G2801-7	C2407-1	--	0.130	83.9	1.41E+18	13.9	72.3
Lower intermediate shell #2	G2802-1	C2331-2	--	0.160[2]	72.2	1.41E+18	15.8	60.8
Lower intermediate shell #3	G2802-2	C2307-2	--	0.210	82.6	1.41E+18	19.1	66.8
Lower intermediate shell axial welds #1 and #3	1-233-A 1-233-C	27204/12008	Linde 1092	0.219	95.0	7.24E+17	19.8	76.2
Lower intermediate shell axial weld #2	1-233-B	27204/12008	Linde 1092	0.219	95.0	8.76E+17	20.7	75.4
Lower shell axial weld #1	2-233-A	12420	Linde 1092	0.270	69.0	6.27E+17	21.9	53.9
Lower shell axial weld #2	2-233-B	12420	Linde 1092	0.270	69.0	9.96E+17	24.3	52.2
Lower shell axial weld #3	2-233-C	12420	Linde 1092	0.270	69.0	6.68E+17	22.2	53.7
Lower to lower intermediate shell circumferential weld	1-240	21935	Linde 1092	0.183[2]	62.0	1.07E+18	19.4	50.0

1. GE Report No. GE-NE-523-159-1292 (Reference 4.2-4).
2. BWRVIP-135, Revision 1 (Reference 4.2-6).

4.2.5 Reactor Vessel Circumferential Weld Inspection Relief

Relief from reactor vessel circumferential weld examination requirements during the fourth ten-year ISI interval has been requested for CNS in NLS2007019 (Reference 4.2-7), revised in NLS2007074 (Reference 4.2-8), and granted in NRC2008008 (Reference 4.2-13). The relief request is based on BWRVIP-05, its associated NRC safety evaluation report (SER), and a supplement to the SER (References 4.2-9 and 4.2-10) and is focused on satisfying the requirements of GL 98-05. The technical basis for the relief request is applicable to the licensed operating term.

NLS2007074 describes and references an analysis that shows the projected CNS reactor vessel parameters after 30 EFPY are comparable to the NRC's 32 EFPY bounding Combustion Engineering (CE) vessel parameters from the BWRVIP-05 SER.

Table 4.2-6 compares the CNS reactor vessel limiting circumferential weld parameters to those used in the NRC analysis. The data in the second column is from Table 2.6-4 of the NRC SER for BWRVIP-05 (Reference 4.2-9). The data in the third column is from the CNS fourth ten-year ISI interval relief request (Reference 4.2-8). The data in the fourth column is from Table 2.6-5 of the Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (Reference 4.2-9). The data in the last column is the projected 54 EFPY data for CNS taken from Table 4.2-2. Consistent with earlier submittals, this table uses surface fluence rather than ¼T fluence and no margin for RT_{NDT}, so the resulting change in RT_{NDT} is different from that shown in Table 4.2-2.

The CNS reactor pressure vessel circumferential weld parameters at 54 EFPY will remain within the NRC's (64 EFPY) bounding CE parameters from the BWRVIP-05 SER. The fact that the values projected to the end of the period of extended operation are less than the 64 EFPY value provided by the NRC leads to the conclusion that the CNS RPV conditional failure probability is less than the conditional failure probability of the NRC analysis. As such, the conditional probability of failure for the circumferential weld remains below that stated in the NRC's Final Safety Evaluation of BWRVIP-05.

Table 4.2-6
CNS Circumferential Weld Evaluation for 54 EFPY

Parameter Description	CE(VIP)[1] 32 EFPY Bounding Parameters	CNS 30 EFPY Bounding Weld (1-240)		CE(VIP)[1] 64 EFPY Bounding Parameters	CNS 54 EFPY Beltline Circumferential Weld (with MUR)
Initial reference temperature (RT_{NDT}), °F	0	-50		0	-50
Neutron fluence at the end of the requested relief period, n/cm^2	2.0E+18	1.57E+18		4.0E+18	1.48E+18
Weld copper content, %	0.13	0.20		0.13	0.183
Weld nickel content, %	0.71	0.69		0.71	0.704
Weld chemistry factor (CF)	151.7	175.30		151.7	172.22
RG 1.99 Position	N/A	C.1, surveillance data not available	C.2, surveillance data available	N/A	C.1
Increase in reference temperature (ΔRT_{NDT}), °F	86.4	87.65	137.61	113.2	86.1
Mean adjusted reference temperature (ART), °F (Initial RT_{NDT} + ΔRT_{NDT})	98.1	37.65	87.61	113.2	36.1

1. Based on chemistry reported by BWRVIP.

Axial Welds

A basic assumption in calculating the failure probability of the circumferential welds is the failure probability of the axial welds.

Table 4.2-7 compares the CNS reactor vessel limiting axial weld parameters to those used by the NRC analysis in BWRVIP-05 (Reference 4.2-9). The data in the middle column is from Table 2.6-5 of the NRC SER for BWRVIP-05 and Table 1 of the NRC SER for BWRVIP-74 (Reference 4.2-11). The data in the right column is the projected 54 EFPY data for CNS taken from Table 4.2-2. (For consistency with the NRC data, the CNS 54 EFPY mean RT_{NDT} is calculated using the peak inner diameter (0t) fluence without margin and hence is lower than the Table 4.2-2 ART value.)

Table 4.2-7
Effects of Irradiation on CNS RPV Axial Weld Properties

Plant / Parameter Description	NRC Limiting Plant-Specific Data	CNS Data for Weld 2-233-B
EFPY	NA	54
Initial (unirradiated) reference temperature (RT_{NDT}), °F	-2	-50
Neutron fluence, n/cm^2	1.50E+18	1.46 E+18
Fluence factor (FF) (calculated per RG 1.99)	0.50	0.497
Weld copper content, %	0.219	0.27
Weld nickel content, %	0.996	1.035
Weld chemistry factor (CF) (calculated per RG 1.99)	231.7	254.43
Increase in reference temperature (ΔRT_{NDT}), °F (FF x CF)	116.0	126.5
Mean adjusted reference temperature (ART), °F (RT_{NDT} + ΔRT_{NDT})	114.0	76.5

The projected 54 EFPY CNS mean ART (76.5ºF) for axial welds is less than the bounding 114ºF shown in the NRC SER for BWRVIP-74 (Reference 4.2-11).

The procedures and training used to limit low temperature over-pressure events will be the same as those in use when CNS requested approval of the BWRVIP-05 technical alternative for the current license term (Reference 4.2-7).

The TLAA associated with reactor vessel circumferential weld inspection relief has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.6 References

4.2-1 NPPD to USNRC, "License Amendment Request to Revise Technical Specifications - Appendix K Measurement Uncertainty Recapture Power Uprate Cooper Nuclear Station Docket 50-298, DPR-46," letter NLS2007069 dated November 19, 2007.

4.2-2 Cooper Nuclear Station Technical Specifications, Amendment 223, October 5, 2006.

4.2-3 BWRVIP-74-A, BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal, June 2003, EPRI Report 1008872 (includes NRC Acceptance for Referencing Report for Demonstration of Compliance with the License Renewal Rule dated October 18, 2001, as Appendix C).

4.2-4 GE Document No. GE-NE-523-159-1292 (DRF B13-01662), Rev. 0, Cooper Nuclear Station Vessel Surveillance Materials Testing and Fracture Toughness Analysis (attached to correspondence NSD930270).

4.2-5 RVID2, "Reactor Vessel Integrity Database, Version 2.0.1," dated July 2000.

4.2-6 BWRVIP-135, Revision 1, EPRI Report 1013400, BWR Vessel and Internals Project, Integrated Surveillance Program (ISP) Data Source Book and Plant Evaluations, June 2007 (BWRVIP 2007-070).

4.2-7 NPPD Letter NLS2007019 to USNRC, "10 CFR 50.55a Request Number RI-29, Revision 0 Cooper Nuclear Station, Docket No. 50-298, DPR-46," dated April 18, 2007.

4.2-8 NPPD to USNRC, "10 CFR 50.55a Request Number RI-29, Revision 1 Cooper Nuclear Station, Docket No. 50-298, DPR-46," letter NLS2007074 dated October 15, 2007.

4.2-9 Strosnider, J. (NRC), to C. Terry (BWRVIP Chairman), "Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC NO. 92925)," letter dated July 28, 1998.

4.2-10 Strosnider, J. (NRC), to C. Terry (BWRVIP Chairman), “Supplement to Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC NO. MA3395)," letter dated March 7, 2000.

4.2-11 Wagoner, V., and T. Mulford (NRC) to all BWRVIP Committee Members, "Acceptance for Referencing of BWRVIP-74 in License Renewal Applications," letter dated October 31, 2001.

4.2-12 Amendment No. 219 to License No. DPR-46, "Cooper Nuclear Station - Issuance of Amendment RE: Revised Pressure Vessel Fluence and Pressure Temperature Curve Applicability to 30 Effective Full-Power Years of Operation (TAC No. MC8728)," dated April 27, 2006.

4.2-13 USNRC to NPPD, “Cooper Nuclear Station—Request for Relief No. RI-29 for Fourth Ten-Year Inservice Inspection Interval Regarding Volumetric Examination of Reactor Pressure Vessel Circumferential Shell Welds (TAC No. MD5260),” letter dated February 6, 2008.

4.3 METAL FATIGUE

Fatigue analyses are potential TLAA for Class 1 and selected non-Class 1 mechanical components. Fatigue is an age-related degradation mechanism caused by cyclic stressing of a component by either mechanical or thermal stresses.

The aging management reviews (Section 3) for CNS identify mechanical components that are within the scope of license renewal and are subject to aging management review. When TLAA – metal fatigue is identified in the aging management program column of the tables in Section 3, associated fatigue analyses are reviewed in this section for TLAA. Review of the TLAA, per 10 CFR 54.21(c)(1), determines whether

(i) the analyses remain valid for the period of extended operation,

(ii) the analyses have been projected to the end of the period of extend operation, or

(iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Fatigue is not an aging effect requiring management unless there is a fatigue analysis required by the design code for the component in question. The aging management reviews conducted as part of the integrated plant assessment (IPA) for license renewal identified all components that are susceptible to fatigue damage. If the component has a fatigue TLAA that remains valid (i) or is projected to cover the period of extended operation (ii), then cracking due to fatigue is not an aging effect requiring management for those components during the period of extended operation. If the TLAA does not remain valid or cannot be projected to cover the period of extended operation, then cracking due to fatigue is an aging effect requiring management for the analyzed component. In those cases, aging management programs will manage cracking due to fatigue in accordance with 10 CFR 54.21(c)(1)(iii).

Components designed in accordance with ASME Section III are required to have fatigue analyses. ASME Section III requires evaluation of fatigue by considering design loading cycles. The CNS Fatigue Monitoring Program monitors transient cycles that contribute to fatigue usage in accordance with requirements in Technical Specification 5.5.5. Cumulative usage factors have been documented and the actual numbers of design transient cycles have been projected to 60 years. A program is in place to track cycles and to provide corrective actions if limits are approached.

The CNS Class 1 piping was originally designed to USAS B31.1–1967 (Section 1.1 of USAR Appendix A). Subsequent replacement piping was designed either to ANSI B31.1 or to ASME Section III. The B31.1 power piping code originated in 1955 as ASA B31.1. In 1967 it became USAS B31.1. It later became ANSI B31.1 and is currently ASME B31.1. As the intention here is only to separate B31.1 fatigue analyses from ASME Section III analyses, the distinction among

ASA, USAS, ANSI, and ASME is not critical to this discussion. Consequently, the remainder of this application will refer to B31.1 with no prefix.

The consideration of fatigue on reactor coolant system pressure boundary piping designed to B31.1 is reflected in the calculation of the allowable stress range. The design of B31.1 Code components incorporates stress range reduction factors based upon the number of thermal cycles. In general, a stress range reduction factor of 1.0 in the stress analyses applies for up to 7000 thermal cycles. The allowable stress range is reduced by the stress range reduction factor if the number of thermal cycles exceeds 7000.

The maximum cumulative usage factors (CUF) identified for CNS Class 1 components are summarized in Section 4.3.1. Fatigue of non-class 1 mechanical components is summarized in Section 4.3.2.

CNS has considered the effect of the reactor water environment on fatigue of components exposed to reactor coolant. A discussion of environmental fatigue factors (F_{en}) and environmentally adjusted CUFs is presented in Section 4.3.3.

In addition to metal fatigue analyses, fracture mechanics analyses of flaw indications discovered during inservice inspection are TLAA for those analyses based on time-limited assumptions defined by the current operating term. When a flaw is detected during inservice inspections, the component that contains the flaw can be evaluated for continued service in accordance with ASME Section XI. These evaluations may show the component is acceptable at the end of the current operating term based on projected inservice flaw growth. Flaw growth is typically predicted based on the design thermal and loading cycles. A review of such flaw growth analyses for CNS has identified none that are TLAA.

4.3.1 Class 1 Fatigue

Class 1 components and systems at CNS that have fatigue analyses include the reactor vessel, portions of the reactor vessel internals, and some Class 1 piping. The CNS Class 1 systems include components within the ASME Section XI, Subsection IWB inspection boundary (see Section 2.3.1 and Section 3.1).

Fatigue evaluations were performed in the design of the CNS Class 1 components in accordance with their design requirements. ASME Section III fatigue evaluations are contained in analyses and stress reports, and because they may be based on a number of transient cycles assumed for a 40-year operating term, these evaluations are considered TLAA.

Design cyclic loadings and thermal conditions for the Class 1 components are defined by the applicable design specifications for each component. The original design specifications provided the initial set of transients that were used in the design of the components and are included as part of each component analysis or stress report.

In accordance with plant Technical Specifications (Section 5.5.5), CNS must ensure that the numbers of transient cycles experienced by the plant remain within the analyzed numbers of cycles. Current design basis fatigue evaluations, including the CUFs, are based on design transients. The design transients are listed in Table 4.3-1.

The Fatigue Monitoring Program tracks and evaluates the cycles and requires corrective actions if limits are approached. The Fatigue Monitoring Program ensures that the numbers of transient cycles experienced by the plant remain within the allowable numbers of cycles, and hence the component CUFs remain below the code allowable value of 1.0. Further details on the Fatigue Monitoring Program are provided in Appendix B.

The numbers of cycles accrued to date have been projected to determine the numbers of cycles expected at the end of 60 years of operation. Table 4.3-1 shows the projected values for the period of extended operation. For CNS, two transients (normal startup and turbine roll) are expected to exceed their analyzed value prior to the end of the period of extended operation. Specifically, normal startups project to reach the analyzed number of cycles for the feedwater piping, feedwater nozzles, main steam piping and core spray piping during the period of extended operation. As additional operating data is accumulated, subsequent projections will refine the number of cycles expected in 60 years. Continued improvements in plant operation could reduce the projected number of normal startups in 60 years to less than the analyzed number of cycles. The Fatigue Monitoring Program will monitor the numbers of cycles of this transient (and all the design transients) and assure action is taken prior to the analyzed numbers of transients being exceeded.

A review of the fatigue evaluations reveals the current cumulative usage factors (CUFs) of record for applicable CNS Class 1 components. The documents reviewed are current design basis fatigue evaluations that do not consider the effects of reactor water environment on fatigue life. The current CUFs of record for Class 1 components are summarized in Table 4.3-2.

4.3.1.1 Reactor Vessel

The vessel is designed, fabricated, inspected, and tested in accordance with the ASME Boiler and Pressure Vessel Code, Section III (1965 Edition and January, 1966, addenda) (USAR Section IV-2.5.1). The original fatigue evaluations were performed by Combustion Engineering (CE), as part of the design, to assure that the cyclic load combinations do not exceed Code allowables and that cumulative usage factors (CUFs) do not exceed 1.0.

The existing fatigue analyses of the reactor vessel are considered TLAA because they are based on numbers of design cycles expected to occur in 40 years of operation. The CUFs of record for the reactor pressure vessel are given in Table 4.3-2.

The most recent review of the reactor vessel fatigue analyses, apart from the license renewal review, was done by General Electric in 2007 for the measurement uncertainty recapture (MUR) power uprate in the spring of 2008. Results of these analyses have been submitted to the NRC as part of the MUR request (Reference 4.3-1). Fatigue analyses for several locations were done using modern techniques and removing some conservatism that resulted in significantly lower CUFs.

The actual numbers of transient cycles remain within analyzed values used for reactor vessel fatigue analyses. CNS will monitor these transient cycles using the Fatigue Monitoring Program and take action if any of the actual cycles approach their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor vessel in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.2 Reactor Vessel Feedwater Nozzle

4.3.1.2.1 Feedwater Nozzle CUF History

The feedwater nozzles were constructed as part of the reactor vessel by the original vessel supplier, Combustion Engineering (CE). The original stress report, developed by CE, predicted that the feedwater nozzle CUF after 40 years of operation would be 0.715.

Stainless steel cladding was originally installed for corrosion protection of the carbon steel nozzle and to minimize rust accumulation in the reactor vessel water. However, cladding on the feedwater nozzles is unnecessary for corrosion protection and the cladding is more susceptible to cracking than the base metal. In response to BWR industry concerns over cracking of the feedwater nozzle blend radius due to rapid cycling, the CNS feedwater nozzles were modified in 1980 by removing the stainless steel cladding to reduce thermal stresses and crack initiation. New feedwater spargers with concentric thermal sleeves were installed and the feedwater nozzles were bored out to a depth that exposed carbon steel base metal. The net effect of cladding removal and consequent reduction in thermal stresses is to reduce crack initiation and reduce the fatigue usage associated with plant startup and shutdown. The decrease in stress results from elimination of the differential thermal expansion between stainless steel and carbon steel. (USAR, Section IV-2.5.1.1)

New feedwater nozzle CUFs were calculated by General Electric taking into account rapid cycling in the nozzle blend region and the feedwater nozzle repair, including removal of cladding and installation of a double-seal, triple-sleeve thermal sleeve. The usage factor due to rapid cycling varies based on the thermal sleeve leakage (clearance). GE assumed that this clearance would increase with time and the thermal sleeves would be periodically reconditioned to restore the clearances to near-original values. Calculating the usage factor with no thermal sleeve reconditioning gave a usage factor greater than one. Therefore, the analysis assumed a reconditioning of the thermal sleeves after 13 years and every 9 years thereafter. With this assumption, the maximum usage factor for the nozzle blend radius is 0.72.

In April 1992 the feedwater nozzle fatigue usage factor was again analyzed, as part of the CNS pipe support qualification project. Usage factors increased over those calculated by GE in 1980. Effects of rapid cycling were included in the analysis.

In 1996 NPPD modified the fatigue analyses. The allowable numbers of cycles were increased to their current limits, and the individual component usage factors for each transient were increased by the ratio of the new numbers of cycles to the old numbers of cycles. The individual usage factors were then summed to give the revised CUF for each component. The results of these analyses are the CUFs of record for the feedwater nozzles.

In 1999 the feedwater nozzle rapid cycling fatigue concern was reviewed. The CUFs for the feedwater nozzle were not recalculated as part of this review. Rather, a 0.25 inch flaw was assumed in the feedwater nozzle, and the review determined that 37 years would be needed for the flaw to grow to the maximum allowable flaw size. This information was used to extend the inspection interval for the feedwater nozzles. This review also justified elimination of the monitoring of bypass leakage. The results of this analysis were transmitted to the NRC via a 1999 letter (Reference 4.3-2). This analysis is not a TLAA as it is not based on the life of the plant.

In November 2007 Cooper submitted a Technical Specification change request (Reference 4.3-1) that included a re-evaluation of the feedwater nozzle fatigue including MUR. The projected CUF for the nozzle/shell junction, including system cycling and rapid cycling, slightly exceeds 1.0. As described in Appendix B, the Fatigue Monitoring Program will manage fatigue of the feedwater nozzle for the period of extended operation.

The CUFs of record for the feedwater nozzles are listed in Table 4.3-2.

4.3.1.2.2 Feedwater Nozzle Cycles Analyzed

The feedwater on/off cycles are not counted by the fatigue monitoring procedure because it is not credible that the analyzed number of cycles (2600) will be reached during the allowed number of shutdowns. CNS data (see Table 4.3-1) does not count these cycles but assumes 6 cycles per shutdown (1050 feedwater cycles for 175 shutdowns to date). This is consistent with the original design assumption of 6 cycles per shutdown. For the projected 225 shutdowns in 60 years, this technique would project only 1350 cycles, well below the 2600 cycles analyzed. Therefore, estimating the feedwater cycles based on the number of shutdowns is adequate.

Feedwater rapid cycling is analyzed based on years of operation, and the number of analyzed years (40) will be exceeded during the period of extended operation. Consequently, the feedwater nozzle CUF cannot be successfully projected for the period of extended operation. The feedwater nozzle is one of the locations identified by NUREG-6260 as requiring consideration of the effects of environmentally assisted fatigue. See Section 4.3.3 for a discussion of the environmentally assisted fatigue analysis of the feedwater nozzles and how CNS will manage the aging effect of fatigue on the feedwater nozzles. CNS will also continue to manage fatigue due to rapid cycling using the BWR Feedwater Nozzle Program. As such, the effects of fatigue on the feedwater nozzles will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.3 Reactor Vessel Internals

The CNS reactor pressure vessel internals are not Class 1 pressure boundary components. As such, no plant-specific fatigue analysis of the entire reactor vessel internals was performed. Fatigue analyses of specific internals piece parts have been performed over the years; however, the only TLAA associated with fatigue of the reactor vessel internals at CNS are the analyses for core plate plugs addressed below. A qualitative review of the internals was performed for the measurement uncertainty recapture, concluding that the governing stresses for all RPV internal components in the MUR condition remain bounded by the existing values. The shroud support and brackets welded to the vessel are considered part of the vessel and had CUFs calculated in the vessel stress report; those CUFs are listed in Table 4.3-2.

4.3.1.3.1 Core Plate Plugs

The 88 core plate bypass holes were plugged in the mid-1970s to eliminate in core instrument vibration that was causing damage to fuel channels. A stress analysis was performed on the plugs considering normal operating conditions, pressure and thermal transients, and installation/ removal operations. The results show acceptable stress levels in all plug components during normal operation and transients.

The analysis of the fatigue life of these plugs is a TLAA. The evaluation concluded that the predicted core plate plug life for stress (fatigue) cracking was 32 EFPY and that the cumulative usage factor (CUF) at 32 EFPY is approximately 0.94 (read from a graph). The BWR Vessel Internals Program will manage cracking due to fatigue of the core plate plugs for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.4 Class 1 Piping

Original piping was designed in accordance with B31.1, "Power Piping." Repairs, replacements and modifications are generally performed in accordance with the original code requirements. The fatigue analysis for piping designed to B31.1 is discussed in Section 4.3.1.4.1 below.

To the extent practical, portions of the reactor coolant pressure boundary piping and nozzle safe ends subject to intergranular stress corrosion cracking (IGSCC) have been replaced with resistant material. The design code for the replaced reactor coolant pressure boundary piping is ASME Section III, 1983 Edition. (Appendix A, Section 3.1 of the USAR) The fatigue analysis for the reactor coolant pressure boundary piping is discussed in Section 4.3.1.4.2 below. The CUFs of record for reactor coolant pressure boundary piping at CNS are listed in Table 4.3-2.

4.3.1.4.1 B31.1 Piping

In the B31.1 code, fatigue is addressed by using stress range reduction factors to reduce stress allowable. Components with less than 7000 equivalent full temperature cycles are limited to the calculated stress allowable without reduction per B31.1. Components that exceed 7000 equivalent full temperature cycles have allowable stresses reduced through the application of stress range reduction factors. Since the RCPB will not exceed 7000 full temperature cycles in 60 years of operation, the existing stress analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

To the extent practical, portions of the reactor water cleanup (RWCU) and the reactor pressure vessel drain line piping subject to IGSCC have been replaced with IGSCC resistant material. The design code for the replaced RWCU/drain line piping is B31.1. (USAR Appendix A, Section 3.1)

4.3.1.4.2 ASME Section III Piping

A review of CNS fatigue analyses found CUFs calculated for reactor recirculation (RR), residual heat removal (RHR), RWCU, main steam (MS), core spray (CS), reactor feedwater (RF), and vessel level sensing lines. The maximum calculated CUFs are given in Table 4.3-2.

CNS will monitor the cycles actually incurred compared to the cycles analyzed using the Fatigue Monitoring Program and assure that action is taken if any of the actual cycles approach their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the ASME Section III piping in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3-1
CNS Projected Cycles for 60 Years

Transient Description	Number of Cycles as of 11/21/2006	60-Year Projected Number of Cycles	Analyzed Number of Cycles
Vessel head removal (unbolt)	26	46	123
Vessel head reinstallation (boltup)	26	46	123
Design pressure test (leak test)	46	74	130
Normal startup (100 °F/hr)	181	245(1)	229
Turbine roll (assumed same as startup)	181	245(1)	229
Normal shutdown (100 °F/hr)	175	225	229
Shutdown flooding	175	225	229
Hot standby (feedwater cycling)	1050(2)	1350(2)	2600
SRV blowdown	1	2	2
SCRAM	97	114	187
Turbine Trip at 25% power	6	8	10
Feedwater heater bypass	2	5	70
Loss of feedwater pumps	23	29	42
Reactor overpressure to 1,375 psig	0	0	1
Improper start of a recirculation loop	0	0	5
Code hydrostatic pressure test	1	1	3
Pipe rupture and blowdown	0	0	1
Operating basis earthquake (OBE)	0	0	5
Safety/relief valve actuations (max per valve)	62(2)	101(2)	250(2)
Core spray injection	0	0	1

1. Section 4.3.1 discusses the projection of normal startups and associated turbine rolls.
2. The values for the S/RV actuations are from Table 4.6-2. The values for the feedwater cycling are from Section 4.3.1.2.2.

Table 4.3-2
CUFs of Record for CNS Class 1 Components[1]

Component/Sub Component	CUF
Reactor Vessel	
Closure shell (flange)	0.08
Vessel shell (flange)	0.10
Closure bolts	0.98
Vessel shell	0.14
Vessel dome at support skirt	0.02
Support skirt forging at vessel	0.06
Core spray nozzle	0.03
CRD hydraulic return nozzle	0.02
Recirculation inlet nozzle	0.38
Recirculation outlet nozzle	0.01
Vent nozzle flange	0.10
Vent nozzle bolts	0.16
Instrument/spray nozzle flange	0.08
Instrument/spray nozzle bolts	0.36
Control rod drive penetrations	0.86
Shroud support plate and RPV shell junction	0.02
Shroud support gussets plate and RPV shell junction	0.37
Shroud and shroud support cylinder	0.38
Refueling canal seal	0.00
Vent nozzle	exempt[2]
6" spray/instrument nozzle	exempt[2]
Steam outlet nozzle	exempt[2]
2" instrument nozzle	exempt[2]
Jet pump instrument nozzle	exempt[2]
Core ΔP nozzle	exempt[2]
Incore instrument nozzle	exempt[2]
Drain nozzle	exempt[2]
Stabilizer bracket	exempt[2]

Table 4.3-2 (Continued)
CUFs of Record for CNS Class 1 Components[1]

Component/Sub Component	CUF
Head lifting lugs	exempt[2]
Insulation brackets	exempt[2]
Internal attachments	exempt[2]
Reactor Vessel Feedwater Nozzle	
Element 193; carbon steel safe end	0.997
Element 478; low alloy steel nozzle blend	0.70
Element 508; low alloy steel nozzle blend	1.06
Reactor Internals	
Core plate plugs	0.94[3]
Class 1 Piping	
RR piping (loop transitions)	1.000
RWCU piping	0.164
RR to RHR tee	0.042
RHR piping (non-replaced)	1.000
Main steam piping	0.929
Main steam drains	0.10
Core spray piping	0.193
Feedwater piping	0.664
Reactor vessel level sensing lines	0.353

1. Based on design transients without environmental fatigue effects.
2. These items were determined to be exempt from calculation of a CUF per paragraph N-415.1 of the 1965 edition of Section III of the ASME Code.
3. Core plate plug CUF is for 32 EFPY and must be recalculated, or the plugs replaced, prior to the period of extended operation. See Section 4.3.1.3 for further details.

4.3.2 Non-Class 1 Fatigue

The design of ASME III Code Class 2 and 3 piping systems incorporates the Code stress reduction factor for determining acceptability of piping design with respect to thermal stresses. In general, 7000 thermal cycles are assumed, allowing a stress reduction factor of 1.0 in the stress analyses. CNS evaluated the validity of this assumption for 60 years of plant operation. The results of this evaluation are that the 7000 thermal cycle assumption will not be exceeded for 60 years of operation. Therefore, the pipe stress calculations remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Non-class 1 components, other than piping system components, required fatigue analyses only if they were built to ASME Section III, NC-3200 or ASME Section VIII, Division 2. CNS has no non-class 1 components built to these codes and therefore has no associated TLAA for components other than piping system components.

4.3.3 Effects of Reactor Water Environment on Fatigue Life

NUREG/CR-6260 (Reference 4.3-5) addresses the application of environmental factors to fatigue analyses (CUFs) and identifies locations of interest for consideration of environmental effects. Section 5.7 of NUREG/CR-6260 identified the following component locations to be the most sensitive to environmental effects for CNS-vintage General Electric plants. These locations are directly relevant to CNS.

(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 nozzles and associated Class 1 piping

(5) Residual heat removal return line Class 1 piping

(6) Feedwater line Class 1 piping

CNS evaluated these six limiting locations using the guidance provided in NUREG-1801 (Reference 4.3-3, Volume 2, Section X.M1). NUREG-1801 calls for using the guidance (formulas) provided in NUREG/CR-5704 (Reference 4.3-4) for austenitic stainless steel and NUREG/CR-6583 (Reference 4.3-6) for carbon steel and low-alloy steel to calculate environmentally assisted fatigue correction factors (F_{en}).

First, as tabulated in Table 4.3-1, CNS projected operating cycles to 60 years. Then, CUFs were calculated based on those projected cycles. Finally, these CUFs were adjusted by multiplying them by fatigue correction factors calculated for the applicable material and environmental conditions. The results of those calculations are presented in Table 4.3-3. There is no analysis of environmentally assisted fatigue (EAF) under the current licensing basis. Rather, the effect on fatigue life of the reactor water environment is a new consideration for license renewal. Applying the F_{en} identified in Table 4.3-3 is not required during the initial 40 years of operation, consistent with the closure of Generic Safety Issue (GSI) 190. As shown in Table 4.3-3, only the feedwater nozzle, core spray nozzle, and RHR piping transition piece have environmentally adjusted projected CUFs greater than 1.0 at the end of the period of extended operation.

CNS will manage the effects of fatigue, including environmentally assisted fatigue, under the Fatigue Monitoring Program for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3-3
CNS CUFs for NUREG/CR-6260 Limiting Locations

NUREG-6260 Components	Material	40-Year Design CUF	60-Year CUF(1)	F_{en}(2)	60-Year EAF CUF
(1) Reactor vessel shell and lower head (CRD pen)	Alloy 600	0.86	0.4956	1.49	0.73840
(2) Reactor vessel feedwater nozzle	LAS	1.06	1.0285	10.4	10.7010
(3) Reactor recirculation piping (inlet nozzle safe end)	SA-182 Gr 316NG	0.38	0.0452	8.36	0.3774
(3) Reactor recirculation piping (outlet nozzle safe end)	SA-182 F304	0.01	0.0117	8.36	0.0976
(4) Core spray piping reactor vessel (nozzle safe end)	SA-182 Gr 316NG	0.193	0.0176	8.36	0.1467
(4) Core spray reactor vessel nozzle	A533 B(1) / A508	0.03	0.1451	10.4	1.5095
(5) Residual heat removal return line Class 1 piping (RHR tee)	SA-312 Type 316	0.896	0.0573	11.79	0.6761
(5) Residual heat removal return line Class 1 piping (transition piece)	A-155 KC-70 (CS)	1.000	0.5967	7.83	4.6742
(6) Feedwater (FW) line Class 1 piping (FW/RWCU/RCIC tee)	A-333 Gr 1 (CS)	0.664	0.0683	2.10	0.1435

1. Recalculated for license renewal by removing conservatism and using the projected 60-year cycles from Table 4.3-1.
2. F_{en} are based on the specific oxygen concentrations at each specific location, adjusted for the time spent with normal water chemistry and the time spent with hydrogen water chemistry.

4.3.4 References

4.3-1 Minahan, S. B. (NPPD), to US NRC Document Control Desk, "License Amendment Request to Revise Technical Specifications - Appendix K Measurement Uncertainty Recapture Power Uprate Cooper Nuclear Station Docket 50-298, DPR-46," letter NLS2007069 dated November 19, 2007.

4.3-2 Swailes, J. H. (NPPD), to USNRC Document Control Desk, "Revised Commitment: Feedwater Nozzle Bypass Leakage Monitoring, Cooper Nuclear Station, NRC Docket No. 50-298, License No DPR-46," letter NLS990060 dated June 23, 1999.

4.3-3 NUREG-1801, *Generic Aging Lessons Learned*, Volumes 1 and 2, Revision 1.

4.3-4 NUREG/CR-5704 (ANL-98/31), *Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels*, April 1999.

4.3-5 NUREG/CR-6260, *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, February 1995.

4.3-6 NUREG/CR-6583 (ANL-97/18), *Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels*, March 1998.

4.4 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRIC EQUIPMENT

The CNS Environmental Qualification (EQ) of Electric Components 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, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. The CNS EQ Program ensures that the EQ components are maintained in accordance with their qualification bases. Equipment qualification evaluations for EQ components that specify a qualification of at least 40 years, but less than 60 years, are considered TLAA for license renewal.

The CNS Environmental Qualification (EQ) of Electric Components Program is an existing program established to meet CNS commitments for 10 CFR 50.49. The program is consistent with NUREG-1801, Section X.E1, "Environmental Qualification (EQ) of Electric Components."

The program includes consideration of operating experience to modify the qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended function(s) during accident conditions after experiencing the effects of inservice aging. Consistent with NRC guidance provided in RIS 2003-09 (Reference 4.4-1), no additional information is required to address GSI 168 (Reference 4.4-2).

The aging effects associated with time-limited aging analyses for environmental qualification of electric equipment will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.1 References

4.4-1 NRC Regulatory Issue Summary 2003-09, Environmental Qualification of Low-Voltage Instrumentation and Control Cables, May 2, 2003.

4.4-2 Generic Safety Issue 168, "Environmental Qualification of Low-Voltage Instrumentation and Control Cables."

4.5 CONCRETE CONTAINMENT TENDON PRESTRESS

This section is not applicable since CNS does not have a concrete containment.

4.6 CONTAINMENT LINER PLATE, METAL CONTAINMENT, AND PENETRATIONS FATIGUE ANALYSIS

Cooper Nuclear Station has a BWR Mark I containment. The design of the drywell, wetwell, and vent system was performed in accordance with the ASME Boiler and Pressure Vessel Code, Section III. The code of record is the latest addenda as of June 1967 and includes Code Cases 1330-1 and 1177-5. Containment piping systems were designed using USAS B31.1 (1967) and USAS B31.7 (February 1968) Power Piping codes. (Reference 4.6-1, Section 1.2.1.1)

Modifications to the containment components and supports were designed, fabricated, and installed in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section III (including Summer 1977 Addenda). Modifications involving new structural components (including new pipe supports) were also designed, fabricated, and installed to the code of record. (Reference 4.6-1, Section 1.2.1.2)

Analyses of the CNS containment are included in the Plant Unique Analysis Report (PUAR) (Reference 4.6-1) and the generic Mark 1 containment report, MPR-751 (Reference 4.6-2). A summary of the usage factors for the CNS containment is presented in Table 4.6-1.

The design basis for containment components requiring evaluation for cyclic loads assumed 40 years of plant operation with one LOCA over the design life. Chugging is part of the design basis for the downcomer/vent header intersection. Besides the design basis LOCA, with the associated chugging loads, the analysis included 500 actuations of each safety/relief valve and five operating basis earthquakes (OBE) (ten cycles per OBE). (Reference 4.6-1, Section 2.7.7 and Table 2.18)

4.6.1 Torus Shell and Shell to Support Welded Connections

The CNS Fatigue Monitoring Program will manage the aging effects due to fatigue of the torus, including torus welded connections, through the period of extended operation. The Fatigue Monitoring Program will monitor the cycles affecting the torus and torus welded connections (S/RV lifts and OBEs) and assure that analyzed numbers of cycles are not exceeded.

4.6.1.1 Torus Shell

The maximum CUF for the as-built torus shell was 0.51 at the butt weld between the torus shell plates of unequal thickness at the torus equator (Reference 4.6-1, Section 3.2.4.2). This analysis was redone in 1997, including the limiting ASME Code fatigue reduction factor of 5 for the entire shell. The maximum CUF from this analysis was 0.947 (Reference 4.6-1, Section 3.2.5.4). Rather than projecting this analysis, CNS will manage the aging effects due to fatigue of the torus shell using cycle-based fatigue monitoring. Thus the Fatigue Monitoring Program will manage the aging effects due to fatigue on the torus shell for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.1.2 Torus Support System Welded Connections

The CUF is 0.29 (Reference 4.6-1, Section 3.3.4.4). CNS will manage the aging effects due to fatigue of the torus support system welded connections using cycle-based fatigue monitoring. Thus the Fatigue Monitoring Program will manage the aging effects due to fatigue on the torus support system welded connections for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.1.3 Ring Girder to Shell Weld

The fatigue usage at the ring girder to shell weld was evaluated for the fatigue design basis and the cumulative usage factor was below one (Reference 4.6-1, Section 3.4.4.3). CNS will manage the aging effects due to fatigue of the torus ring girder to shell weld using cycle-based fatigue monitoring. Thus the Fatigue Monitoring Program will manage the aging effects of fatigue on the ring girder to shell weld for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.1.4 Shell Penetrations and Attachments

Section 3.5.4.3 of Reference 4.6-1 states,

> Fatigue usage was checked at all penetrations (both at the nozzles and the edge of the insert plate), and at all attachments using the fatigue design basis in Subsection 2.7.7. In evaluating fatigue usage a penetration is subjected to reactions due to chugging loads from both internal and external piping. The local stress intensity was based on an SRSS [square root of the sum of the squares] of the internal and external reactions. For consideration of local stress intensity, absolute summation of internal and external reactions is a potential design concern. For fatigue evaluation, the assumption that the internal and external reactions add absolutely throughout an IBA [intermediate break accident], SBA [small break accident], or DBA vent is unnecessarily conservative. SRSS combination of these reactions for the fatigue evaluation only is therefore justifiable. The cumulative usage factors at all torus shell penetrations and attachments are within allowables.

CNS will manage the aging effects due to fatigue of the torus penetrations and attachments using cycle-based fatigue monitoring. Thus the Fatigue Monitoring Program will manage the aging effects due to fatigue on penetrations and attachments for the torus for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.2 Torus Vent System

Vent system components were checked against fatigue as required by ASME Code rules for MC (metal containment) components. Only critical stress regions were evaluated for fatigue. These regions were generally areas of high local stresses around penetrations and intersections/joints.

Stress concentration factors were developed to calculate peak stresses from the primary plus secondary stress ranges determined in the analyses. (Reference 4.6-1, Sections 4.2.4.8 and 4.3.4.4)

4.6.2.1 Main Vent Intersection with Vent Header

The torus hard pipe vent is designed and constructed in accordance with USAS (ANSI) B31.7 1969, as documented in Section 3.1 of USAR Appendix A.

The CUF is 0.15 (Reference 4.6-1, Section 4.2.4.8.1). CNS will manage the aging effects due to fatigue of the main vent/vent header intersection using cycle-based fatigue monitoring. Thus the Fatigue Monitoring Program will manage the aging effects due to fatigue on the vent/vent header for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.2.2 Vent Header Miter Joint

The CUF is 0.34 (Reference 4.6-1, Section 4.2.4.8.2). CNS will manage the aging effects due to fatigue of the vent header miter joint using cycle-based fatigue monitoring. Thus the Fatigue Monitoring Program will manage the aging effects due to fatigue on the header miter joint for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.2.3 Main Vent Bellows

The bellows expansion joints are designed for 62 psig and 300 °F. The cycle life is specified to be a minimum of 7,000 cycles. (USAR Chapter V, Section 2.3.4.2) The original CUF is less than 0.01 (Reference 4.6-1, Section 4.2.4.8.3). Conservatively multiplying the CUFs by 1.5 shows that the CUF for the main vent bellows would be only 0.015 for 60 years of operation. This CUF has thus been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(ii).

4.6.2.4 Main Vent Safety/Relief Valve Discharge Line Penetrations

The three safety valves discharge directly into the drywell and as such have no discharge piping or discharge piping penetrations. The eight relief valve discharge lines (RVDL) are routed through the main vent and terminate in a quencher discharge device located in the suppression pool. The Cooper S/RV discharge lines do not directly penetrate the torus as they pass through the torus inside the vent headers. The Cooper S/RV discharge lines do penetrate the vent headers, and it is those penetrations that are discussed below.

In evaluating fatigue usage at the main vent S/RVDL penetration, the fatigue design basis assumes 250 S/RV actuations during normal plant operation. For the 250 S/RV actuations assumed, the fatigue usage at the penetration is below 1.0. (Reference 4.6-1, Section 4.2.4.8.4)

NPPD reviewed plant operating history to determine the number of S/RV lifts to date, from which the number of lifts expected in 60 years of operation can be projected. The results of this projection are presented in Table 4.6-2. The projection is 769 total relief valve lifts with 101 lifts maximum for any one valve. As this projection is still well below the 250 lifts per valve assumed in the analysis, this TLAA will remain valid for the period of extended operation. Nonetheless, the Fatigue Monitoring Program will manage the aging effects due to fatigue of the S/RVDL penetrations for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.2.5 Downcomer and Tiebars

The maximum CUF for the downcomer/vent header intersection is 0.49 (Reference 4.6-1, Section 4.3.4.4). This includes the effects of normal operation (about 84% of the total CUF) and from post-LOCA chugging (about 16% of the total CUF). CNS will manage the aging effects due to fatigue of the downcomer/vent header intersection using cycle-based fatigue monitoring. Thus the Fatigue Monitoring Program will manage the aging effects due to fatigue on the downcomer and tiebar for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.3 Safety/Relief Valve Discharge Piping

The relief valve discharge piping was designed, installed, and tested as outlined in USAR Appendix A, and modified for increased structural safety margins during the CNS Mark I Containment Short Term Program (STP) (USAR Chapter IV, Section 4.6).

The S/RV discharge piping evaluations are discussed in USAR Appendix C, Section C-3.3.3.5.2. (USAR Chapter IV, Section 4.5)

The fatigue analysis of the CNS S/RV discharge line piping is bounded by MPR-751, the GE Mark 1 containment program (Reference 4.6-2). MPR-751 was prepared to bound all BWR plants which utilize the Mark I containment design. The analysis concluded that for all plants and piping systems considered, in all cases the fatigue usage factors for an assumed 40-year plant life was less than 0.5. In a worst-case scenario, extending plant life by an additional 20 years would produce usage factors below 0.75. Since this is less than 1.0, the fatigue criteria are satisfied. The MPR-751 generic fatigue analysis is thus projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.6.4 Torus Attached Piping

For torus attached piping (internal and external to the torus), the results of the generic GE Mark I containment program (based on 40 years of operation) were that 92% of the torus-attached piping (TAP) would have cumulative usage factors of less than 0.3, and that 100% would have usage factors less than 0.5. In particular, the locations reported for CNS were all less than 0.3.

Conservatively multiplying the CUFs by 1.5 shows that for 60 years of operation, 92% of the TAP (including the CNS TAP) would have CUFs below 0.45, and 100% would have CUFs below 0.75. These calculations have thus been projected to the end of the period of extended operation in accordance with 10 CFR 50.21(c)(ii).

4.6.5 Torus Piping Penetrations

Type 1 piping penetration assemblies include expansion joint bellows to accommodate the relative movement between the pipe and the drywell shell. The bellows expansion joints are designed for 62 psig and 300°F. The cycle life is specified to be a minimum of 7000 cycles over a period of 40 years. (USAR Chapter V, Section 2.3.4.2) A cycle of the bellows occurs due to relative motion of the penetrating pipe due to heatup or cooldown of the system to which that pipe belongs. CNS evaluated the validity of this assumption for 60 years of plant operation. The results of this evaluation are that the 7000 thermal cycle assumption is valid and bounding for 60 years of operation. Therefore, the pipe stress calculations remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Table 4.6-1
Summary of CNS Containment Usage Factors

Location	Usage Factor
Torus Shell and Supports	
Torus shell	0.947 (1)
Torus support system welded connections	0.29 (1)
Ring girder to shell weld	< 1 (1)
Torus shell penetrations and attachments	Within Allowables (1)
Vent System	
Main vent/vent header intersection	0.15 (1)
Vent header miter joint	0.34 (1)
Main vent bellows	0.015 (2)
Main vent S/RVDL penetration	< 1.0 (2)
Downcomers and tiebars	0.49 (1)
Safety and Relief Valve Discharge (S/RVD) Piping	
S/RVD piping	0.75 (2)
Torus Attached Piping (TAP)	
Piping systems external to torus (TAP)	0.45 (2)
Piping systems internal to torus (TAP)	0.45 (2)

1. Usage factors listed in this table for locations crediting the Fatigue Monitoring Program are based on the analyzed numbers of cycles in Table 4.3-1. The Fatigue Monitoring Program assures analyzed numbers remain valid.
2. Usage factors for other locations are based on projections of cycles to 60 years of operation for transients that do not require tracking in the Fatigue Monitoring Program.

Table 4.6-2
CNS Projected Safety/Relief Valve (SRV) Lifts

Safety/Relief Valve	Number of Lifts as of 11/21/2006	60-Year Projected Number of Lifts	Analyzed Number of Lifts
SRV A	57	96	250
SRV B	55	94	250
SRV C	58	97	250
SRV D	60	99	250
SRV E	53	92	250
SRV F	62	101	250
SRV G	57	96	250
SRV H	59	98	250
Total	461	769	N/A

4.6.6 References

4.6-1 Nebraska Public Power District, *Cooper Nuclear Station, Plant Unique Analysis Report, Mark I Containment Program*, Revised, February 26, 2007.

4.6-2 Technical Report MPR-751, Mark I Containment Program Augmented Class 2/3 Fatigue Evaluation Method and Results for Typical Torus Attached and SRV Piping Systems, November 1982.

4.7 OTHER PLANT-SPECIFIC TLAA

4.7.1 Core Plate Plugs

A CNS calculation documents the evaluation for expected service life of the core plate plugs. A total of 88 plugs, each consisting of a shaft, body, body pin, latch and spring, were installed in the bypass flow holes of the core support plate to limit flow through bypass holes and reduce the flow-induced vibration of in-core neutron monitors and start-up sources against the corners of fuel assemblies. Life limits for these plugs were established based upon spring relaxation (change in material properties), radiation embrittlement (change in material properties), intergranular stress corrosion cracking (IGSCC), and fatigue. As such, the calculation is a TLAA.

The evaluation concluded that core plate plugs would remain functional and will not present a loose parts concern for lives on the order of 32 EFPY as limited by spring relaxation. The predicted plug life for both spring relaxation and for stress (fatigue) cracking was determined to be 32 EFPY. As described in Section 4.3.1.3.1, the CUF would exceed 1.0 prior to 54 EFPY, therefore the BWR Vessel Internals Program will be enhanced to include management of plugs in the core plate bypass holes.

The effects of aging associated with the core plate plugs will be managed for the period of extended operation in accordance with 10 CFR54.21(c)(1)(iii).

4.7.2 TLAA in BWRVIP Documents

The BWR Vessel and Internals Project (BWRVIP) documents identify various potential TLAA. The TLAA applicable to CNS are described below.

4.7.2.1 BWRVIP-74-A, Reactor Pressure Vessel

BWRVIP-74-A (Reference 4.7-1) identifies four potential TLAA that are also acknowledged in the associated NRC SER (Appendix C of BWRVIP-74-A). The four potential TLAA are discussed below.

(1) Pressure/Temperature Curve Analyses

The SER concludes that a set of P-T curves should be developed for the heatup and cooldown operating conditions in the plant at a given EFPY in the period of extended operation. Section 4.2.3 addresses the TLAA associated with CNS P-T curves.

(2) Fatigue

The SER states that the license renewal applicant should not rely solely on the analysis in BWRVIP-74-A but should verify that the number of cycles assumed in the original fatigue design is conservative. Section 4.3.1.1 addresses fatigue of the reactor pressure vessel.

The SER also states that NRC staff concerns on environmental fatigue were not resolved and that each applicant should address environmental fatigue for the components covered by BWRVIP-74-A. Section 4.3.3 addresses environmentally assisted fatigue.

(3) Equivalent Margins Analysis for RPV Materials with Charpy USE Less than 50 ft-lbs

Section 4.2.4 addresses the TLAA associated with equivalent margin analyses for upper shelf energy (USE).

(4) Material Evaluation for Exempting RPV Circumferential Welds from Inspection

BWRVIP-74-A reiterated the conclusion of BWRVIP-05 that reactor pressure vessel circumferential welds could be exempted from 100% examination and provided the corresponding criteria for exemption. Section 4.2.5 addresses the TLAA associated with reactor vessel circumferential weld inspection relief.

4.7.3 References

4.7-1 BWRVIP-74-A, BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal, June 2003, EPRI Report 1008872 (includes NRC Acceptance for Referencing Report for Demonstration of Compliance with the License Renewal Rule dated October 18, 2001, as Appendix C).

APPENDIX A

UPDATED SAFETY ANALYSIS REPORT SUPPLEMENT

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A.0 INTRODUCTION

This appendix provides the information to be submitted in an Updated Safety Analysis Report (USAR) Supplement as required by 10 CFR 54.21(d) for the Cooper Nuclear Station (CNS) License Renewal Application (LRA). Appendix B of the CNS LRA provides descriptions of the programs and activities that manage the effects of aging for the period of extended operation. Section 4 of the LRA documents the evaluations of time-limited aging analyses for the period of extended operation. Appendix B and Section 4 have been used to prepare the summary program and activity descriptions for the CNS USAR Supplement information in this appendix.

The information presented in this section will be incorporated into the USAR following issuance of the renewed operating license. Upon inclusion of the USAR Supplement in the CNS USAR, future changes to the descriptions of the programs and activities will be made in accordance with 10 CFR 50.59.

The following information will document aging management programs and activities credited in the Cooper Nuclear Station (CNS) license renewal review (Section A.1.1) and time-limited aging analyses evaluated for the period of extended operation (Section A.1.2). References to other sections are to USAR sections, not to sections in the LRA.

A.1 AGING MANAGEMENT PROGRAMS AND ACTIVITIES

The CNS license renewal application (Reference A.1-1) and information in subsequent related correspondence provided sufficient basis for the NRC to make the findings required by 10 CFR 54.29 (Final Safety Evaluation Report) (Reference A.1-2). As required by 10 CFR 54.21(d), this USAR supplement contains a summary description of the programs and activities for managing the effects of aging (Section A.1.1) and a description of the evaluation of time-limited aging analyses for the period of extended operation (Section A.1.2). The period of extended operation is the 20 years after the expiration date of the original operating license.

A.1.1 <u>Aging Management Programs</u>

The integrated plant assessment for license renewal identified aging management programs necessary to provide reasonable assurance that components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis (CLB) for the period of extended operation. This section describes the aging management programs and activities required during the period of extended operation. All aging management programs will be implemented prior to entering the period of extended operation.

CNS quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The CNS Quality Assurance Program applies to safety-related structures and components. Corrective actions and administrative (document) control for both safety-related and nonsafety-related structures and components are accomplished per the existing CNS Corrective Action

Program and Document Control Program and are applicable to all aging management programs and activities that will be required during the period of extended operation. The confirmation process is part of the Corrective Action Program and includes reviews to assure adequacy of proposed actions, tracking and reporting of open corrective actions, and review of corrective action effectiveness. Any follow-up inspection required by the confirmation process is documented in accordance with the Corrective Action Program. The corrective action, confirmation process, and administrative controls of the CNS (10 CFR Part 50, Appendix B) Quality Assurance Program are applicable to all aging management programs and activities required during the period of extended operation.

A.1.1.1 Aboveground Steel Tanks Program

The Aboveground Steel Tanks Program is a new program that will manage loss of material from external surfaces of outdoor, aboveground carbon steel tanks by periodic visual inspection of external surfaces and thickness measurement of locations that are inaccessible for external visual inspection.

This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M29, Aboveground Steel Tanks, prior to the period of extended operation.

A.1.1.2 Bolting Integrity Program

The Bolting Integrity Program is an existing program that relies on recommendations for a comprehensive bolting integrity program, as delineated in NUREG-1339, industry recommendations, and Electric Power Research Institute (EPRI) NP-5769, with the exceptions noted in NUREG-1339 for safety-related bolting. The program relies on industry recommendations for comprehensive bolting maintenance, as delineated in EPRI TR-104213 for pressure retaining bolting and structural bolting.

The program applies to bolting and torquing practices of safety- and nonsafety-related bolting for pressure retaining components, NSSS component supports, and structural joints. The program addresses all bolting regardless of size except reactor head closure studs, which are addressed by the Reactor Head Closure Studs Program [Section A.1.1.32]. The program includes periodic inspection of closure bolting for signs of leakage that may be due to crack initiation, loss of preload, or loss of material due to corrosion. The program also includes preventive measures to preclude or minimize loss of preload and cracking.

The Bolting Integrity Program will be enhanced as follows.

- Include guidance from EPRI NP-5769 and EPRI TR-104213 for material selection and testing, bolting preload control, ISI, plant operation and maintenance, and evaluation of the structural integrity of bolted joints.

- Clarify that actual yield strength is used in selecting materials for low susceptibility to stress corrosion cracking, that the use of lubricants containing MoS_2 is prohibited for bolting at CNS, and that proper gasket compression will be visually verified following assembly.

- Include guidance from EPRI NP-5769 and EPRI TR-104213 for replacement of non-Class 1 bolting and disposition of degraded structural bolting.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.3 Buried Piping and Tanks Inspection Program

The Buried Piping and Tanks Inspection Program is a new program that will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, gray cast iron, and stainless steel components. Preventive measures will be in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components will be inspected when excavated during maintenance. If trending within the corrective action program identifies susceptible locations, the areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement.

Prior to entering the period of extended operation, plant operating experience will be reviewed to verify that an inspection occurred within the past ten years. If an inspection did not occur, a focused inspection will be performed prior to the period of extended operation. A focused inspection will be performed within the first ten years of the period of extended operation, unless an opportunistic inspection occurs within this ten-year period. A “focused inspection” is defined as an inspection performed in areas with a history of corrosion problems and in areas with the highest likelihood of corrosion problems.

This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M34, Buried Piping and Tanks Inspection, prior to the period of extended operation.

A.1.1.4 BWR CRD Return Line Nozzle Program

The BWR Control Rod Drive (CRD) Return Line Nozzle Program is an existing program. Under this program, CNS has cut and capped the CRD return line nozzle to mitigate fatigue cracking and continues Inservice Inspection (ISI) examinations using ASME Section XI to monitor the effects of crack initiation and growth on the intended function of the control rod drive return line nozzle. ISI examinations include ultrasonic inspection of the nozzle inside radius section and nozzle-to-vessel weld. CNS also conducts UT examinations of the CRD return line nozzle-to-cap weld in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) document BWRVIP-75-A as part of the BWR Stress Corrosion Cracking Program [Section A.1.1.7].

A.1.1.5 BWR Feedwater Nozzle Program

The BWR Feedwater Nozzle Program is an existing program. Under this program, CNS has removed feedwater nozzle cladding and installed a double piston ring, triple thermal sleeve sparger to mitigate cracking. This program implements enhanced inservice inspection (ISI) of the feedwater nozzles in accordance with the requirements of ASME Section XI, Subsection IWB and the recommendation of General Electric (GE) NE 523-A71-0594-A to detect cracking.

A.1.1.6 BWR Penetrations Program

The BWR Penetrations Program is an existing program that includes (a) inspection and flaw evaluation in conformance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) documents BWRVIP-27-A and BWRVIP-49-A and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel penetrations and nozzles.

A.1.1.7 BWR Stress Corrosion Cracking Program

The BWR Stress Corrosion Cracking Program is an existing program that includes (a) preventive measures to mitigate intergranular stress corrosion cracking (IGSCC), and (b) inspection and flaw evaluation to monitor IGSCC and its effects on reactor coolant pressure boundary components made of stainless steel, CASS, or nickel alloy.

CNS has taken actions to prevent IGSCC and will continue to use materials resistant to IGSCC for component replacements and repairs following the recommendations delineated in NUREG-0313, Generic Letter 88-01, Generic Letter 88-01 Supplement 1, and the staff-approved BWRVIP-75-A report. Inspection of piping identified in NRC Generic Letter 88-01 to detect and size cracks is performed in accordance with the staff positions on schedule, method, personnel qualification, and sample expansion included in the generic letter and the staff-approved BWRVIP-75-A report.

A.1.1.8 BWR Vessel ID Attachment Welds Program

The BWR Vessel ID Attachment Welds Program is an existing program that includes (a) inspection and flaw evaluation in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) BWRVIP-48-A and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 (EPRI Report 1008192) to ensure the long-term integrity and safe operation of reactor vessel inside diameter (ID) attachment welds and support pads.

A.1.1.9 BWR Vessel Internals Program

The BWR Vessel Internals Program is an existing program that includes (a) inspection, flaw evaluation, and repair in conformance with the applicable, staff-approved BWR reactor vessel and internals project (BWRVIP) documents and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel internal components. In addition, the BWR Vessel Internals Program includes inspection of the steam dryer in accordance with BWRVIP-139 guidance.

The BWR Vessel Internals Program will be enhanced as follows.

- Include actions to replace the plugs in the core plate bypass holes based on their qualified life.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.10 Containment Inservice Inspection Program

The Containment Inservice Inspection Program is an existing program that manages loss of material and cracking for the primary containment and its integral attachments. The program uses the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition, through the 2003 Addenda.

Visual inspections for IWE monitor loss of material of the steel containment shells and their integral attachments; containment hatches and airlocks; moisture barriers; and pressure-retaining bolting by inspecting surfaces for evidence of flaking, blistering, peeling, discoloration, and other signs of distress.

The Containment Inservice Inspection Program will be enhanced as follows.

- Provide guidance for surfaces requiring augmented examination to require accessible areas to be examined using a visual examination method and surface areas not accessible on the side requiring augmented examination to be examined using an ultrasonic thickness measurement method in accordance with IWF-2500 (b).

- Provide guidance to document material loss in a local area exceeding ten percent of the nominal containment wall thickness or material loss in a local area projected to exceed ten percent of the nominal containment wall thickness before the next examination in accordance with IWE-3511.3 for volumetric inspections.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.11 Containment Leak Rate Program

The Containment Leak Rate Program is an existing program. As described in 10 CFR Part 50, Appendix J, containment leak rate tests are required to assure that (a) leakage through reactor containment and systems and components penetrating containment shall not exceed allowable values specified in technical specifications or associated bases and (b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of containment, and systems and components penetrating containment. The program utilizes 10 CFR 50 Appendix J, Option B, and the guidance in NRC Regulatory Guide 1.163 and NEI 94-01.

A.1.1.12 Diesel Fuel Monitoring Program

The Diesel Fuel Monitoring Program is an existing program that entails sampling to ensure that adequate diesel fuel quality is maintained to prevent loss of material in fuel systems. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic sampling and analysis, draining and cleaning of tanks, and verifying the quality of new fuel oil before its introduction into the storage tanks.

Sampling and analysis activities are in accordance with technical specifications for fuel oil purity and the guidelines of ASTM Standards ASTM D4057 and D975.

The One-Time Inspection Program [Section A.1.1.29] describes inspections planned to verify that the Diesel Fuel Monitoring Program has been effective at managing aging effects.

The Diesel Fuel Monitoring Program will be enhanced as follows.

- Use ASTM Standard D4057 for sampling of the diesel fire pump fuel oil storage tank.
- Include periodic visual inspections and cleaning, as well as ultrasonic bottom surface thickness measurement, of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank.
- Include periodic multilevel sampling of the diesel fuel oil day tanks and the diesel fire pump fuel oil storage tank.
- Provide the acceptance criterion of $\leq$ 10 mg/l for the determination of particulates in the diesel fire pump fuel oil storage tank.
- Specify acceptance criterion for UT thickness measurements of the bottom surfaces of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.13 Environmental Qualification (EQ) of Electric Components Program

The Environmental Qualification (EQ) of Electric Components Program is an existing program that manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components are refurbished, replaced, or their qualification is extended prior to reaching the aging limits established in the evaluation. Some aging evaluations for EQ components are time-limited aging analyses (TLAAs) for license renewal.

A.1.1.14 External Surfaces Monitoring Program

The External Surfaces Monitoring Program is an existing program that inspects external surfaces of components subject to aging management review. The program is also credited with managing loss of material from internal surfaces for situations in which internal and external material and environment combinations are the same such that external surface condition is representative of internal surface condition. This program does not manage aging effects on structures.

Surfaces that are inaccessible during plant operations are inspected during refueling outages. Surfaces that are insulated are inspected when the external surface is exposed (i.e., during maintenance). Surfaces are inspected at frequencies to assure the effects of aging are managed such that applicable components will perform their intended function during the period of extended operation.

The External Surfaces Monitoring Program will be enhanced as follows.

- Clarify that periodic inspections of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3) will be performed. Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(2).

This enhancement will be implemented prior to the period of extended operation.

A.1.1.15 Fatigue Monitoring Program

The Fatigue Monitoring Program is an existing program that tracks the number of critical thermal and pressure transients for selected reactor coolant system components, in order not to exceed design limits on fatigue usage. The program ensures the validity of analyses that explicitly assumed a fixed number of thermal and pressure transients by assuring that the actual effective number of transients does not exceed the assumed limit.

This program also addresses the effects of the coolant environment on component fatigue life by assessing the impact of the reactor coolant environment on a sample of critical components for the plant.

The Fatigue Monitoring Program will be enhanced as follows.

- Consideration of the effect of the reactor water environment will be accomplished through implementation of one or more of the following options for the feedwater nozzles, core spray nozzles and RHR pipe transition.

  (1) Update the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment. This includes applying the appropriate F_{en} factors to valid CUFs determined using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case).

  (2) Repair or replace the affected locations before exceeding a CUF of 1.0.

- The CNS Fatigue Monitoring Program will be enhanced to require the recording of each transient associated with the actuation of a safety/relief valve (SRV).

Enhancements will be implemented at least two years prior to entering the period of extended operation.

A.1.1.16 Fire Protection Program

The Fire Protection Program is an existing program that includes a fire barrier inspection and a diesel-driven fire pump inspection. The fire barrier inspection requires periodic visual inspection of fire barrier penetration seals, fire dampers, fire stops, fire wraps, 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 diesel-driven fire pump inspection requires that the pump and its driver be periodically tested and inspected to ensure that diesel engine fuel supply lines can perform their intended functions.

The Fire Protection Program also includes periodic inspection and testing of the CO_2 and Halon fire suppression systems.

The Fire Protection Program will be enhanced as follows.

- Explicitly state that the diesel fire pump engine sub-systems (including the fuel supply line) shall be observed while the engine is running. Acceptance criteria will be revised to verify that the diesel engine does not exhibit signs of degradation while running, such as excessive fuel oil, lube oil, coolant, or exhaust gas leakage.

- Specify that diesel fire pump engine carbon steel exhaust components are inspected for evidence of corrosion or cracking at least once every five years.

- Require visual inspections of fire damper framing to check for signs of degradation.

- Require visual inspections of the Halon and CO_2 fire suppression systems at least once every six months to check for signs of degradation in a manner suitable for trending.

- Include inspection of cardox hose reels for corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion.

- Include visual inspections of concrete flood curbs, manways, hatches, and hatch covers on an 18-month basis to check for signs of degradation.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.17 Fire Water System Program

The Fire Water System Program is an existing program that applies to water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, and aboveground and underground piping and components that are tested in accordance with applicable National Fire Protection Association (NFPA) codes and standards. Such testing assures functionality of systems. To determine if significant corrosion has occurred in water-based fire protection systems, periodic flushing, system performance testing and inspections are conducted. Also, many of these systems are normally maintained at required operating pressure and monitored such that leakage resulting in loss of system pressure is immediately detected and corrective actions initiated.

In addition, wall thickness evaluations of fire protection piping are periodically performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion.

A sample of sprinkler heads will be tested or replaced using the guidance of NFPA-25 (2002 edition), Section 5.3.1.1.1. NFPA-25 states, "Where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing." This sampling will be repeated every ten years after initial field service testing per the guidance of NFPA-25.

The Fire Water System Program will be enhanced as follows.

- Include inspection of hose reels for corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion.

- Include visual inspection of spray and sprinkler system internals for evidence of corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion.

- Wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.

- A sample of sprinkler heads required for 10 CFR 50.48 will be tested or replaced using guidance of NFPA-25 (2002 edition), Section 5.3.1.1.1, before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.18 Flow-Accelerated Corrosion Program

The Flow-Accelerated Corrosion (FAC) Program is an existing program that applies to safety-related and nonsafety-related carbon steel components and gray cast iron in systems containing high-energy fluids carrying two-phase or single-phase high-energy fluid greater than or equal to two percent of plant operating time per the criteria given in EPRI NSAC-202L.

The program, based on EPRI recommendations in NSAC-202L for an effective flow-accelerated corrosion program, predicts, detects, and monitors FAC in plant piping and other pressure retaining components. This program includes (a) an evaluation to determine critical locations, (b) initial operational inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm predictions, or repair or replace components as necessary. The aging effect of loss of material managed by the Flow-Accelerated Corrosion Program is equivalent to the aging effect of wall thinning as defined in NUREG-1801 Volume 2 Table IX.E.

The FAC Program will be enhanced as follows.

- Update the System Susceptibility Analysis for the Flow-Accelerated Corrosion Program to reflect the lessons learned and new technology that became available after the publication of NSAC-202L Revision 1.

This enhancement will be implemented prior to the period of extended operation.

A.1.1.19 Inservice Inspection – ISI Program

The Inservice Inspection – ISI Program is an existing program that encompasses ASME Section XI Subsection IWB, IWC, and IWD requirements.

This program manages loss of material, cracking, and reduction of fracture toughness to assure that the pressure boundary functions of the reactor pressure vessel and reactor coolant system pressure boundary are maintained through the period of extended operation.

Regulation 10 CFR 50.55a imposes inservice inspection (ISI) requirements of ASME Code, Section XI, for Class 1, 2, and 3 pressure-retaining components, their integral attachments, and supports in light-water cooled power plants. Inspection, repair, and replacement of these components are covered in Subsections IWB, IWC, and IWD respectively. The program includes periodic visual, surface, and volumetric examination and leakage tests of Class 1, 2, and 3 pressure-retaining components, their integral attachments and supports.

The ISI Program is based on ASME Inspection Program B, which has ten-year inspection intervals. Every ten years the program is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50.55a. On March 1, 2006, CNS entered the fourth ISI interval. The ASME code edition and addenda used for the fourth interval is the 2001 Edition, 2003 Addenda.

A.1.1.20 Inservice Inspection – IWF Program

The Inservice Inspection – IWF Program is an existing program that manages loss of material for ASME Class 1, 2, 3 and MC piping and component supports, bolting, and base plates. The program uses the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition, 2003 Addenda.

The program includes visual inspections of surfaces to manage loss of material. Evidence of corrosion, deformation, misalignment, improper clearances, improper spring settings, damage to close tolerance machined or sliding surfaces, and missing, detached, or loosened support items that may compromise support function or load capacity are detected through visual inspection.

The Inservice Inspection – IWF Program will be enhanced as follows.

- Clarify that Class MC piping and component supports are included in the program.
- Clarify that the successive inspection requirements of IWF-2420 and the additional examination requirements of IWF-2430 are applied.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.21 Masonry Wall Program

The Masonry Wall Program is an existing program that manages aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation.

The program includes visual inspection of all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included components are 10 CFR 50.48-required masonry walls, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components. Structural steel components of masonry walls are managed by the Structures Monitoring Program [Section A.1.1.36].

Masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

The Masonry Wall Program will be enhanced as follows.

- Clarify that the control house – 161 kv switchyard is included in the program.
- Clarify that structures with conditions classified as "acceptable with deficiencies" or "unacceptable" shall be entered into the corrective action program.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.22 Metal-Enclosed Bus Inspection Program

The Metal Enclosed Bus Inspection Program is a new program that inspects the following non-segregated phase bus.

- non-segregated bus between the emergency station service transformer and 4.16 kV switchgear buses (1F and 1G).
- non-segregated bus between the start-up station service transformer X-winding and 4.16 kV switchgear buses (1A and 1B).

Inspections of the metal enclosed bus (MEB) will include the bus and bus connections, the bus enclosure assemblies, and the bus insulation and insulators. A sample of the accessible bolted connections will be inspected for loose connections. The bus enclosure assemblies will be inspected for loss of material and elastomer degradation. This program will be used instead of the Structures Monitoring Program for external surfaces of the bus enclosure assemblies. The bus insulation or insulators will be inspected for degradation leading to reduced insulation resistance (IR). These inspections will include visual inspections, as well as quantitative measurements, such as thermography or connection resistance measurements, as required.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.E4, Metal-Enclosed Bus, prior to the period of extended operation.

A.1.1.23 Neutron Absorber Monitoring Program

The Neutron Absorber Monitoring Program is an existing program that manages loss of material of Boral neutron absorption panels in the spent fuel racks. The program relies on representative coupon samples mounted in surveillance assemblies located in the spent fuel pool to monitor performance of the absorber material without disrupting the integrity of the storage system.

Surveillance assemblies are removed from the spent fuel pool on a prescribed schedule and physical and chemical properties are measured. From this data, the stability and integrity of Boral in the storage cells are assessed.

A.1.1.24 Non-EQ Bolted Cable Connections Program

The Non-EQ Bolted Cable Connections Program is a new program which provides a one-time inspection, on a sampling basis, to confirm the absence of age-related degradation of bolted cable connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. Connections associated with cables within the scope of license renewal are considered for this program. The factors considered for sample selection will be application (medium and low voltage, defined as < 35 kV), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc.). The technical basis for the sample selections will be documented. If an unacceptable condition or situation is identified in the selected sample, the corrective action program will be used to evaluate the condition and determine appropriate corrective action.

This program will be implemented prior to the period of extended operation.

A.1.1.25 Non-EQ Inaccessible Medium-Voltage Cable Program

The Non-EQ Inaccessible Medium-Voltage Cable Program is a new program that inspects the following underground medium-voltage cables.

- inaccessible medium-voltage cables between the station service water pumps (SWP-1A, 1B, 1C, and 1D) and the 4.16 kV safety switchgear
- inaccessible medium-voltage cables between 12.5 kV overhead loop and the fire pump motor (FP-MOT-E)
- inaccessible medium-voltage cables between the standby diesel (DG1 and DG2) to the 4.16 kV safety busses (1F and 1G)
- inaccessible medium-voltage cables between the 4.16 kV non-safety buses (1A and 1B) and the 161 kV control house power transformers (located in the 345 kV switchyard)

The Non-EQ Inaccessible Medium-Voltage Cable Program entails periodic inspections for water collection in cable manholes and periodic testing of cables. In-scope medium-voltage cables (cables with operating voltage from 2 kV to 35 kV) exposed to significant moisture and voltage will be tested at least once every ten years to provide an indication of the condition of the conductor insulation. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that lasts less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time.

The program includes inspections for water accumulation in manholes at least once every two years.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements, prior to the period of extended operation.

A.1.1.26 Non-EQ Instrumentation Circuits Test Review Program

The Non-EQ Instrumentation Circuits Test Review Program is a new program that inspects the applicable cables in the following systems or sub-systems.

- neutron monitoring system intermediate range monitors
- neutron monitoring system local power range monitors
- neutron monitoring system average power range monitors
- reactor building ventilation exhaust radiation monitors
- main steam line radiation monitors

The Non-EQ Instrumentation Circuits Test Review Program assures the intended functions of sensitive, high-voltage, low-signal cables exposed to adverse localized equipment environments caused by heat, radiation and moisture (i.e., neutron flux monitoring instrumentation, reactor building ventilation exhaust radiation monitoring, and main steam line radiation monitoring) can 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 before 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 system (such as insulation resistance tests or time domain reflectometry) will occur at least once every ten years, with the first test occurring before the period of extended operation. This program will consider the technical information and guidance provided by the industry.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E2, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.

A.1.1.27 Non-EQ Insulated Cables and Connections Program

The Non-EQ Insulated Cables and Connections Program is a new program that assures the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is significantly more severe than the specified service condition for the insulated cable or connection.

A representative sample of accessible insulated cables and connections within the scope of license renewal will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. The program sample consists of all accessible cables and connections in localized adverse environments.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements, prior to the period of extended operation.

A.1.1.28 Oil Analysis Program

The Oil Analysis Program is an existing program that maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to loss of material, cracking, or fouling. Activities include sampling and analysis of lubricating oil for detrimental contaminants, water, and particulates.

Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results.

The One-Time Inspection Program [Section A.1.1.29] utilizes inspections or non-destructive evaluations of representative samples to verify that the Oil Analysis Program has been effective at managing aging effects.

The Oil Analysis Program will be enhanced as follows.

- Include viscosity, neutralization number, and flash point determination of oil samples from components that do not have regular oil changes, along with analytical ferrography and elemental analysis for the identification of wear particles.

- Include screening for particulate and water content for oil replaced periodically.

- Formalize preliminary oil screening for water and particulates and laboratory analyses, including defined acceptance criteria for all components included in the scope of the program. The program will specify corrective actions in the event acceptance criteria are not met.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.29 One-Time Inspection Program

The One-Time Inspection Program is a new program that will include measures to verify effectiveness of an aging management program (AMP) and confirm the insignificance of an aging effect. For structures and components that rely on an AMP, this program will verify effectiveness of the AMP by confirming that unacceptable degradation is not occurring and the intended function of a component will be maintained during the period of extended operation. One-time inspections may be needed to address concerns for potentially long incubation periods for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, or (b) an aging effect is expected to progress very slowly. For these cases, there will be confirmation that either (a) the aging effect is indeed not occurring, or (b) the aging effect is occurring very slowly as not to affect the component or structure intended function. A one-time inspection of the subject component or structure is appropriate for this verification. The inspections will be nondestructive examinations (including visual, ultrasonic, or surface techniques). The inspection will be performed within the ten years prior to the period of extended operation.

The elements of the One-Time Inspection Program include (a) determination of the sample size 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 aging effect; (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) evaluation of the need for follow-up examinations to monitor the progression of any aging degradation.

A one-time inspection activity is used to verify the effectiveness of the Diesel Fuel Monitoring Program by confirming that unacceptable loss of material is not occurring on components within systems managed by the Diesel Fuel Monitoring Program [Section A.1.1.12].

A one-time inspection activity is used to verify the effectiveness of the Oil Analysis Program by confirming that unacceptable cracking, loss of material, and fouling is not occurring on components within systems managed by the Oil Analysis Program [Section A.1.1.28].

A one-time inspection activity is used to verify the effectiveness of the three water chemistry control programs by confirming that unacceptable cracking, loss of material, and fouling is not occurring on components within systems managed by water chemistry control programs [Sections A.1.1.38, A.1.1.39, and A.1.1.40].

One-time inspection activities on the following are used to confirm that loss of material, cracking, and reduction of fracture toughness, as applicable, are not occurring or are so insignificant that an aging management program is not warranted.

- main steam line flow elements
- reactor recirculation flow elements
- internal surfaces of stainless steel components in the standby gas treatment system containing raw water (drain water)
- internal surfaces of stainless steel tubing in the circulating water system containing raw water (river water)
- internal surfaces of stainless steel tubing and components in the off gas system containing raw water (drain water)
- internal surfaces of stainless steel components in the radwaste system containing raw water (drain water)
- Internal surfaces of stainless steel tubing and components in the service air system exposed to condensation

The program provides for increasing inspection sample size and locations in the event that aging effects are detected. Unacceptable inspection findings are evaluated in accordance with the corrective action process to determine the need for subsequent (including periodic) inspections and for monitoring and trending the results.

For specific system components where significant aging effects are not expected, one-time inspection activities are used to confirm that loss of material, cracking, and reduction of fracture toughness, as applicable, are not occurring or are so insignificant that an aging management program is not warranted. When evidence of an aging effect is revealed by a one-time inspection, routine evaluation of the inspection results will identify appropriate corrective actions.

This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M32, One-Time Inspection.

A.1.1.30 One-Time Inspection – Small-Bore Piping Program

The One-Time Inspection – Small-Bore Piping Program is a new program applicable to small-bore American Society of Mechanical Engineers (ASME) Code Class 1 piping less than 4 inches nominal pipe size (NPS 4"), which includes pipe, fittings, and branch connections. The ASME Code does not require volumetric examination of Class 1 small-bore piping. The CNS One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will manage cracking through the use of volumetric examinations.

The program will include a sample selected based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small-bore piping locations.

When evidence of an aging effect is revealed by a one-time inspection, evaluation of the inspection results will identify appropriate corrective actions.

The inspection will be performed within the ten years prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M35, One-Time Inspection of ASME Code Class 1 Small-Bore Piping.

A.1.1.31 Periodic Surveillance and Preventive Maintenance Program

The Periodic Surveillance and Preventive Maintenance Program is an existing program that includes periodic inspections and tests that manage aging effects not managed by other aging management programs. In addition to specific activities in the plant's preventive maintenance program and surveillance program, the Periodic Surveillance and Preventive Maintenance Program includes enhancements to add new activities. The preventive maintenance and surveillance testing activities are generally implemented through repetitive tasks or routine monitoring of plant operations. The program is credited with managing loss of material from external surfaces for situations in which external and internal material and environment combinations are the same such that internal surface condition is representative of external surface condition.

Surveillance testing and periodic inspections using visual or other non-destructive examination techniques verify that the following components are capable of performing their intended function.

- reactor building monorails, railroad airlock doors, reactor building crane, rails and girders, and refueling bridge equipment assembly
- elastomer seals for railroad airlock doors
- SLC system accumulator shells
- HPCI system turbine lube oil heat exchanger tubes
- ADS piping and T-quenchers in waterline region of the suppression chamber
- RCIC system vacuum pump discharge piping, piping elements, and components
- RCIC system turbine lube oil heat exchanger tubes
- SGT system components
- SGT system fan inlet flexible connections
- plant drain system components
- DG system exhaust gas components
- DG system intercooler tubes and fins
- DG system service air components
- HVAC system flexible duct connections
- HVAC system portable blower fan housings and flexible trunks kept in storage that may be used for ventilation
- HVAC system fan coil unit tubes, fins and drip pan
- PC system equipment and floor drain components

- piping, piping components, and piping elements in the circulating water system, nonradioactive floor drain system, heating and ventilation system, off gas system, potable water system, radwaste system, diesel generator starting air system, and service air system
- service air primary containment penetration X-21
- nitrogen system vaporizer tank and vaporizer coil

The Periodic Surveillance and Preventive Maintenance Program will be enhanced as follows.

- Enhance as necessary to assure 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.

- For each activity that refers to a representative sample, a representative sample will be selected for each unique material and environment combination. The sample size will be determined in accordance with Chapter 4 of EPRI 107514, Age Related Degradation Inspection Method and Demonstration, which outlines a method to determine the number of inspections required for 90% confidence that 90% of the population does not experience degradation (90/90).

Enhancements will be implemented prior to the period of extended operation.

A.1.1.32 Reactor Head Closure Studs Program

The Reactor Head Closure Studs Program is an existing program that includes inservice inspection (ISI) in conformance with the requirements of ASME Section XI, Subsection IWB, and preventive measures (e.g., rust inhibitors, stable lubricants, appropriate materials) to mitigate cracking and loss of material of reactor head closure studs, nuts, washers, and bushings.

A.1.1.33 Reactor Vessel Surveillance Program

The Reactor Vessel Surveillance Program is an existing program that manages reduction in fracture toughness of reactor vessel beltline materials to assure that the pressure boundary function of the reactor pressure vessel is maintained through the period of extended operation.

CNS has received NRC approval to use the BWR vessel and internals project (BWRVIP) Integrated Surveillance Program (ISP). The Reactor Vessel Surveillance Program monitors changes in the fracture toughness properties of ferritic materials in the reactor pressure vessel (RPV) beltline region. As BWRVIP-ISP capsule test reports become available for RPV materials representative of CNS, the actual shift in the reference temperature for nil-ductility transition of the vessel material may be updated. In accordance with 10 CFR 50 Appendices G and H, CNS reviews relevant test reports to assure compliance with fracture toughness requirements and P-T limits.

BWRVIP-116, "BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," describes the design and implementation of the ISP during the period of extended operation. BWRVIP-116 identifies additional capsules of the Supplemental Surveillance Program (SSP), their withdrawal schedule, and contingencies to ensure that the requirements of 10 CFR 50 Appendix H are met through the period of extended operation.

The Reactor Vessel Surveillance Maintenance Program will be enhanced as follows.

- If the CNS standby capsule is removed from the reactor vessel without the intent to test it, the capsule will be stored in a manner which maintains it in a condition which would permit its future use, including during the period of extended operation, if necessary.
- Ensure that the additional requirements specified in the final NRC safety evaluation for BWRVIP-116 will be addressed before the period of extended operation.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.34 Selective Leaching Program

The Selective Leaching Program is a new program that will ensure the integrity of components made of cast iron, bronze, brass, and other alloys exposed to condensation, raw water, steam, treated water, and soil (groundwater) that may lead to selective leaching. The program will include a one-time visual inspection, hardness measurement (where feasible based on form and configuration), or other industry accepted mechanical inspection techniques of selected components that may be susceptible to selective leaching to determine whether loss of material due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended function through the period of extended operation.

This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M33, Selective Leaching of Materials, prior to the period of extended operation.

A.1.1.35 Service Water Integrity Program

The Service Water Integrity Program is an existing program that relies on implementation of the recommendations of GL 89-13 to ensure that the effects of aging on the service water (SW) system will be managed through the period of extended operation. The program includes component inspections for cracking, erosion, corrosion, wear, and blockage and performance monitoring to verify the heat transfer capability of the safety-related heat exchangers cooled by SW. Periodic cleaning and flushing of redundant or infrequently used loops are the methods used to control or prevent fouling within the heat exchangers and loss of material in SW components.

A.1.1.36 Structures Monitoring Program

The Structures Monitoring Program is an existing program that performs inspections in accordance with 10 CFR 50.65 (Maintenance Rule) as addressed in Regulatory Guide 1.160 and NUMARC 93-01. Periodic inspections are used to monitor the condition of structures and structural commodities to ensure there is no loss of intended function.

Since protective coatings are not relied upon to manage the effects of aging for structures included in the Structures Monitoring Program, the program does not address protective coating monitoring and maintenance.

The Structures Monitoring Program will be enhanced as follows.

- Clarify that the following structures are included in the program.
    - biological shield wall
    - control room ceiling support system
    - crane rails and girders
    - CRD shootout steel
    - diesel fuel tank hatch cover
    - diesel fuel tank retaining wall and slab
    - drywell fill slab
    - drywell shell protection panels and jet deflectors
    - drywell stabilizer supports
    - foundations (buildings)
    - guide wall
    - manholes and duct banks
    - monorails
    - new fuel storage vault
    - office building (or administration building)
    - oil tank bunker crushed rock fill
    - pump baffle plates
    - reactor building loop seal drain caps
    - reactor building railroad airlock doors
    - reactor building sump structure
    - reactor cavity floor and walls
    - reactor cavity liner
    - reactor pedestal
    - sacrificial shield wall (steel portion)
    - sacrificial shield wall lateral supports
    - service water pipe slab
    - shield plugs
    - spent fuel pool floor and walls
    - steam tunnel

- sumps and sump liners
- transformer yard and switchyard support structures and foundations
- transmission towers (galvanized), wooden utility towers, wooden utility poles, and foundations
- traveling screen casing and associated framing

- Clarify that, in addition to structural steel and concrete, the following commodities are inspected for each structure as applicable.

  - anchor bolts
  - anchorage/embedments
  - base plates
  - battery racks
  - beams, columns, floor slabs, and walls (below grade)
  - blowout panels (including east end of steam tunnel)
  - cable trays and supports
  - component and piping supports
  - conduits and conduit supports
  - electrical and instrument panels and enclosures
  - equipment pads and foundations
  - exterior walls
  - flood curbs
  - flood, pressure and specialty doors
  - flood retention materials (spare parts)
  - HVAC duct supports
  - instrument line supports
  - instrument racks, frames, and tubing trays
  - manways, hatches, manhole covers, and hatch covers
  - missile shields
  - penetration sealant (flood, radiation)
  - penetration sleeves and sealant (mechanical/electrical not penetrating PC boundary)
  - pipe whip restraints
  - seals and gaskets (doors, manways and hatches)
  - stairs and handrails, platforms, grating, decking, and ladders
  - support pedestals
  - vents and louvers

- Inspect inaccessible concrete areas that are submerged or below grade which may become exposed due to excavation, construction or other activities. CNS will also inspect inaccessible concrete areas when observed conditions in accessible areas exposed to the same environment indicate that significant concrete degradation is occurring.

- Inspect elastomers (seals, gaskets, and roof elastomers) to identify cracking and change in material properties.

- Perform an engineering evaluation of groundwater samples to assess aggressiveness of groundwater to concrete on a periodic basis (at least once every five years). CNS will obtain samples from a well that is representative of the groundwater surrounding below-grade site structures. Samples will be monitored for sulfates, pH and chlorides.

- Perform visual structural examinations of wood to identify loss of material and change in material properties.

- Perform visual structural monitoring of the oil tank bunker crushed rock fill to identify loss of form.

- Clarify that structures with conditions classified as "acceptable with deficiencies" or "unacceptable" shall be entered into the corrective action program.

Enhancements will be implemented prior to the period of extended operation.

A.1.1.37 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is a new program that will assure reduction of fracture toughness due to thermal aging and reduction of fracture toughness due to radiation embrittlement will not result in loss of intended function. This program will evaluate CASS components in the reactor vessel internals and require non-destructive examinations as appropriate.

This program will supplement reactor vessel internals inspections required by the BWR Vessel Internals Program [Section A.1.1.9] and the Inservice Inspection – ISI Program [Section A.1.1.19] to manage the effects of loss of fracture toughness due to thermal aging and neutron embrittlement of cast austenitic stainless steel (CASS) components.

This aging management program includes

(a) identification of susceptible components determined to be limiting from the standpoint of thermal aging susceptibility (i.e., ferrite and molybdenum contents, casting process, and operating temperature) and/or neutron irradiation embrittlement (neutron fluence), and

(b) for each "potentially susceptible" component, aging management is accomplished through either a supplemental examination of the affected component during the period of extended operation, or a component-specific evaluation to determine its susceptibility to reduction of fracture toughness.

This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program, prior to the period of extended operation.

A.1.1.38 Water Chemistry Control – Auxiliary Systems Program

The Water Chemistry Control – Auxiliary Systems Program is an existing program that manages loss of material and cracking for components exposed to treated water and steam.

Program activities include sampling and analysis of water in auxiliary condensate drain system components, auxiliary steam system components, and heating and ventilation system components to minimize component exposure to aggressive environments.

The One-Time Inspection Program [Section A.1.1.29] utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – Auxiliary Systems Program has been effective at managing aging effects.

A.1.1.39 Water Chemistry Control – BWR Program

The Water Chemistry Control – BWR Program is an existing program that manages aging effects caused by corrosion and cracking mechanisms. The program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (BWRVIP-130). BWRVIP-130 has three sets of guidelines: one for primary water, one for condensate and feedwater, and one for control rod drive (CRD) mechanism cooling water. EPRI guidelines in BWRVIP-130 also include recommendations for controlling water chemistry in the torus/pressure suppression chamber, condensate storage tank, demineralized water storage tanks, and spent fuel pool.

The Water Chemistry Control – BWR Program optimizes the primary water chemistry to minimize the potential for loss of material and cracking. This is accomplished by limiting the levels of contaminants in the reactor coolant system that could cause loss of material and cracking. Additionally, CNS has instituted hydrogen water chemistry and noble metal chemical addition to limit the potential for IGSCC through the reduction of dissolved oxygen in the treated water.

The One-Time Inspection Program [Section A.1.1.29] utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – BWR Program has been effective at managing aging effects.

A.1.1.40 Water Chemistry Control – Closed Cooling Water Program

The Water Chemistry Control – Closed Cooling Water Program is an existing program that includes preventive measures that manage loss of material, cracking, and fouling for components in closed cooling water systems: diesel generator jacket water (DGJW) system, reactor equipment cooling (REC) system, and turbine equipment cooling (TEC) system. These chemistry activities provide for monitoring and controlling closed cooling water chemistry using CNS procedures and processes based on EPRI guidance for closed cooling water chemistry.

The One-Time Inspection Program [Section A.1.1.29] utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – Closed Cooling Water Program has been effective at managing aging effects.

A.1.2 Evaluation of Time-Limited Aging Analyses

In accordance with 10 CFR 54.21(c), an application for a renewed license requires an evaluation of time-limited aging analyses for the period of extended operation. The following time-limited aging analyses have been identified and evaluated to meet this requirement.

A.1.2.1 Reactor Vessel Neutron Embrittlement

The reactor vessel neutron embrittlement time-limited aging analyses, including consideration for the measurement uncertainty recapture (MUR) power uprate for cycle 25 and beyond, either have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) or will be managed for the period of extended operation in accordance with 10 CFR 54.24(c)(1)(iii) as summarized below.

Based on the plant operating history and assuming 100 percent capacity factor through the period of extended operation, CNS will not surpass 50 EFPY. However, 54 EFPY (90 percent capacity factor times 60 years) is conservatively used as the end of the period of extended operation to evaluate reactor vessel neutron embrittlement time-limited aging analyses.

A.1.2.1.1 Reactor Vessel Fluence

Calculated fluence is based on a time-limited assumption defined by the operating term. Therefore, analyses that evaluate reactor vessel neutron embrittlement based on calculated fluence are time-limited aging analyses.

The high energy (> 1 MeV) neutron fluence for the welds and shells of the reactor pressure vessel beltline region was determined using the Radiation Analysis Modeling Application (RAMA) fluence method which adheres to the guidance prescribed in Regulatory Guide 1.190.

A.1.2.1.2 Adjusted Reference Temperature

The change in reference temperature of nil-ductility transition (ΔRT_{NDT}) and adjusted reference temperature (ART) values were projected to 54 EFPY using the methods described in Regulatory Guide 1.99 Revision 2. Credible surveillance data and the integrated surveillance program (ISP) were used to determine chemistry factors and best-estimate chemistry values for the lower intermediate shell plates. All projected values for ART are below the 200°F suggested in Section 3 of Regulatory Guide 1.99 as an acceptable value of ART for the end of the period of extended operation.

The time-limited aging analysis for adjusted reference temperature has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.1.2.1.3 Pressure-Temperature Limits

Appendix G of 10 CFR 50 requires that the reactor vessel remain within established pressure-temperature (P-T) limits during boltup, hydro-test, pressure tests, normal operation, and anticipated operational occurrences. These limits are calculated using materials and fluence data, including data obtained through the Reactor Vessel Surveillance Program.

The P-T limit curves will continue to be updated, as required by Appendix G of 10 CFR Part 50, assuring that limits remain valid through the period of extended operation.

The aging effects associated with the reactor vessel pressure-temperature limits will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

A.1.2.1.4 Upper-Shelf Energy

The predictions for percent drop in Charpy upper shelf energy (C_VUSE) values were projected to 54 EFPY using projected beltline fluence values, chemistry and surveillance data, and un-irradiated C_VUSE information in accordance with Regulatory Guide 1.99. All projected C_VUSE values for 54 EFPY remain above the 50 ft-lb minimum acceptable value specified in Appendix G of 10 CFR 50.

The time-limited aging analyses for upper shelf energy have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.1.2.1.5 Reactor Vessel Circumferential Weld Inspection Relief

Relief from reactor vessel circumferential weld examination requirements during the fourth ten-year ISI interval for CNS was requested in 2007. The relief request is based on BWRVIP-05 and the associated NRC safety evaluation report (SER), and its supplement (References A.1-4 and A.1-5). The relief request is applicable for the remaining portion of the current operating license.

The CNS reactor pressure vessel circumferential weld parameters at 54 EFPY will remain within the NRC's (64 EFPY) bounding CE parameters from the BWRVIP-05 SER. The fact that the values projected to the end of the period of extended operation are less than the 64 EFPY value provided by the NRC leads to the conclusion that the CNS RPV conditional failure probability is less than the conditional failure probability of the NRC analysis. As such, the conditional probability of failure for circumferential welds remains below that determined during the NRC's final safety evaluation of BWRVIP-05.

Axial Welds

A basic assumption in calculating the failure probability of the circumferential welds is the failure probability of the axial welds.

The CNS reactor vessel limiting axial weld parameters were compared to those used in the NRC analysis in BWRVIP-05 (Reference A.1-4). The projected 54 EFPY CNS mean ART for axial welds is less than the value shown in the NRC SER for BWRVIP-74 (Reference A.1-6).

The time-limited aging analysis for reactor vessel circumferential weld inspection relief has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.1.2.2 Metal Fatigue

A.1.2.2.1 Class 1 Metal Fatigue

Fatigue evaluations were performed in the design of the CNS Class 1 components in accordance with their design requirements. ASME Section III fatigue evaluations are contained in analyses and stress reports, and because they may be based on a number of transient cycles assumed for a 40-year operating term, these evaluations are considered time-limited aging analyses.

Design cyclic loadings and thermal conditions for the Class 1 components are defined by the applicable design specifications for each component. The original design specifications provided a set of transients that were used in the design of the components and are included as part of each component analysis or stress report.

The Fatigue Monitoring Program tracks and evaluates the cycles and requires corrective actions if limits are approached. The Fatigue Monitoring Program ensures that the numbers of transient cycles experienced by the plant remain within the analyzed numbers of cycles, and hence the component CUFs remain below the code allowable value of 1.0.

Reactor Vessel

The design code for the reactor vessel is specified in Section IV-2.5.1 of the USAR. Fatigue evaluations for the reactor vessel were performed as part of the vessel design. The fatigue analyses of the reactor vessel are considered time-limited aging analyses because they are based on numbers of design cycles expected to occur in 40 years of operation.

The actual numbers of transient cycles remain within analyzed values used for reactor vessel fatigue analyses. CNS will monitor these transient cycles using the Fatigue Monitoring Program and assure that action is taken if any of the actual cycles approach their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor vessel in accordance with 10 CFR 54.21(c)(1)(iii).

Reactor Vessel Feedwater Nozzle

As discussed in USAR Section IV-2.5.1.1, the feedwater nozzles were modified in 1980 to remove stainless steel cladding in order to reduce thermal stresses and crack initiation.

In 2007, Cooper submitted a Technical Specification change request (Reference A.1-3) that included a re-evaluation of the feedwater nozzle fatigue including MUR. The projected CUF for the nozzle/shell junction, including system cycling and rapid cycling, slightly exceeds 1.0.

The feedwater rapid cycling is analyzed based on years of operation, and the number of analyzed years (40) will be exceeded during the period of extended operation. Consequently, the feedwater nozzle CUF cannot be successfully projected for the period of extended operation. The feedwater nozzle is one of the locations identified by NUREG-6260 for assessment of the effects of the reactor water environment on fatigue. See Section A.1.2.2.3 for a discussion of the environmentally assisted fatigue analysis of the feedwater nozzles and how CNS will manage the aging effect due to fatigue on the feedwater nozzles. CNS will continue to manage fatigue due to rapid cycling using the BWR Feedwater Nozzle Program. As such, the effects of fatigue on the feedwater nozzles will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Reactor Vessel Internals

The CNS reactor pressure vessel internals are not Class 1 pressure boundary components. As such, no plant specific fatigue analysis of the entire reactor vessel internals was performed. Fatigue analyses of specific internals piece parts have been performed over the years; however, the only time-limited aging analyses associated with fatigue of the reactor vessel internals at CNS are the core plate plugs addressed below in Section A.1.2.5. A qualitative review of the internals was performed for the MUR power uprate, and it was concluded that the governing stresses for all RPV internal components in the MUR condition remain bounded by the existing values. The shroud support and brackets welded to the vessel are considered part of the vessel and had CUFs calculated in the vessel stress report.

Class 1 Piping

Original piping was designed in accordance with B31.1, "Power Piping." Other Class IS piping is designed to meet the supplementary requirements included in Section A-3.1 of the USAR.

Repairs, replacements and modifications are generally performed in accordance with the original code requirements. As permitted by ASME Section XI, later editions of the code or ASME III have been used for some modifications at CNS. To the extent practical, portions of the Class IN piping and nozzle safe ends subject to intergranular stress corrosion cracking (IGSCC) have been replaced with resistant material. The design code for the replaced piping is ASME Section III, 1983 Edition per Section A-3.1 of the USAR.

In the B31.1 code, fatigue is addressed by using stress range reduction factors to reduce stress allowable. Components with less than 7000 equivalent full temperature cycles are limited to the calculated stress allowable without reduction per B31.1. Components that exceed 7000 equivalent full temperature cycles have allowable stresses reduced through the application of stress range reduction factors. Since the reactor coolant pressure boundary will not exceed 7000 full temperature cycles in 60 years of operation, the existing stress analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

To the extent practical, portions of the reactor water cleanup (RWCU) and the reactor pressure vessel drain line piping subject to IGSCC have been replaced with IGSCC-resistant material. The design code for the replaced piping is B31.1, as discussed in Section A-3.1 of the USAR.

Specific to the ASME Section III piping, a review of CNS fatigue analyses found CUFs calculated for reactor recirculation (RR), residual heat removal (RHR), RWCU, main steam (MS), core spray (CS), reactor feedwater (RF), and reactor pressure vessel level sensing lines.

For the ASME Section III piping, CNS will monitor the cycles actually incurred compared to the cycles analyzed using the Fatigue Monitoring Program and assure that action is taken if any of the actual cycles approach their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the ASME Section III piping in accordance with 10 CFR 54.21(c)(1)(iii).

A.1.2.2.2 Non-Class 1 Metal Fatigue

The design of ASME III Code Class 2 and 3 piping systems incorporates the Code stress reduction factor for determining acceptability of piping design with respect to thermal stresses. In general, 7000 thermal cycles are assumed, allowing a stress reduction factor of 1.0 in the stress analyses. CNS evaluated the validity of this assumption for 60 years of plant operation. The results of this evaluation indicate that the 7000 thermal cycle assumption will not be exceeded for 60 years of operation. Therefore, the pipe stress calculations remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Non-Class 1 components, other than piping system components, required fatigue analyses only if they were built to ASME Section III, NC-3200 or ASME Section VIII, Division 2. CNS has no non-Class 1 components built to these codes and therefore has no associated time-limited aging analyses for components other than piping system components.

A.1.2.2.3 Effects of Reactor Water Environment on Fatigue Life

NUREG/CR-6260 (Reference A.1-9) addresses the application of environmental factors to fatigue analyses (CUFs) and in Section 5.7 identifies the locations most sensitive to environmental effects for CNS vintage General Electric plants. These locations are relevant to CNS.

(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 nozzles and associated Class 1 piping

(5) Residual heat removal return line Class 1 piping

(6) Feedwater line Class 1 piping

CNS evaluated these six locations using environmentally assisted fatigue correction factors (F_{en}).

Based on the analysis, only the feedwater nozzle, core spray nozzle, and RHR piping transition piece have environmentally adjusted CUFs greater than 1.0. These CUFs will exceed 1.0 at the beginning of the period of extended operation when environmental effects are considered. Due to the factor of safety included in the ASME code, a CUF of greater than 1.0 does not indicate that fatigue cracking is expected. However, there is a higher potential for fatigue cracking during the period of extended operation at locations having CUFs exceeding 1.0.

The effects of environmentally assisted fatigue will be managed by the Fatigue Monitoring Program for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

A.1.2.3 Environmental Qualification of Electrical Components

The CNS Environmental Qualification (EQ) of Electric Components Program implements the requirements of 10 CFR 50.49 (as further defined by the Division of Operating Reactors Guidelines, NUREG-0588, and Reg. Guide 1.89). The program requires action before individual components exceed their qualified life. In accordance with 10 CFR 54.21(c)(1)(iii), implementation of the EQ Program provides reasonable assurance that the effects of aging on components associated with EQ time-limited aging analyses will be adequately managed such that the intended functions can be maintained for the period of extended operation.

A.1.2.4 Fatigue of Primary Containment, Attached Piping, and Components

Analyses of the CNS containment are included in the Plant Unique Analysis Report (PUAR) (Reference A.1-7) and the generic Mark 1 containment report, MPR-751 (Reference A.1-8).

The CUF for the torus shell was determined to be 0.51 at the butt weld between the torus shell plates of unequal thickness at the torus equator. However, the initial analysis was redone in 1997, including the limiting ASME Code fatigue reduction factor of 5 for the entire shell. This new analysis yielded a CUF of 0.947. Rather than projecting this analysis, CNS will manage the aging effects due to fatigue of the torus shell using cycle-based fatigue monitoring. Thus the Fatigue Monitoring Program will manage the aging effects due to fatigue on the torus shell for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

The fatigue analysis of the S/RV discharge line piping is bounded by MPR-751, the GE Mark 1 containment program (Reference A.1-8). MPR-751 was prepared to bound all BWR plants which utilize the Mark I containment design. The analysis concluded that for all plants and piping systems considered, in all cases the fatigue usage factors for an assumed 40-year plant life was less than 0.5. In a worst-case scenario, extending plant life by an additional 20 years would produce usage factors below 0.75. Since this is less than 1.0, the fatigue criteria are satisfied.

For torus attached piping (internal and external to the torus), the results of the generic GE Mark I containment program (based on 40 years of operation) were that the torus attached piping would have cumulative usage factors of less than 0.5. In particular, the locations reported for CNS were all less than 0.3. Conservatively multiplying the CUFs by 1.5 demonstrates that for 60 years of operation, the torus attached piping for CNS would have CUFs below 0.75.

Therefore, the analysis for the S/RV discharge piping and other attached piping has been projected to the end of the period of extended operation in accordance with 10 CFR 50.21(c)(ii).

For Type 1 torus piping penetration assemblies, including expansion joint bellows, the cycle life is specified to be a minimum of 7000 cycles over a period of 40 years. The 7000 thermal cycle assumption is valid and bounding for 60 years of operation. Therefore, the torus piping penetration stress calculations remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.1.2.5 Core Plate Plugs

The 88 core plate bypass holes were plugged in the mid-1970s to eliminate in core instrument vibration that was causing damage to fuel channels. A stress analysis was performed on the plug considering normal operating conditions, pressure and thermal transients, and installation/ removal operations. The results show acceptable stress levels in all plug components during normal operation and transients.

The analysis of the fatigue life of these plugs is a time-limited aging analysis. The evaluation concluded that the predicted core plate plug life for both spring relaxation and for stress (fatigue) cracking was 32 EFPY and that the cumulative usage factor (CUF) at 32 EFPY is approximately 0.94, based on plotted data. The slope of the curve in this evaluation is such that it appears the CUF would exceed 1.0 prior to 54 EFPY. Cracking due to fatigue of the core plate plugs will be managed by the BWR Vessel Internals Program, with enhancement to include management of plugs in the core plate bypass holes, for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

A.1.3 References

A.1-1 [CNS License Renewal Application—later]

A.1-2 [NRC SER for CNS License Renewal—later]

A.1-3 NPPD Letter NLS2007069 to USNRC, "License Amendment Request to Revise Technical Specifications - Appendix K Measurement Uncertainty Recapture Power Uprate Cooper Nuclear Station Docket 50-298, DPR-46," November 19, 2007.

A.1-4 Strosnider, J. (NRC) to C. Terry (BWRVIP Chairman), "Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC NO. 92925)," letter dated July 28, 1998.

A.1-5 Strosnider, J. (NRC) to C. Terry (BWRVIP Chairman), Supplement to Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC NO. MA3395)," letter dated March 7, 2000.

A.1-6 Wagoner, V., and T. Mulford (NRC) to All BWRVIP Committee Members, "Acceptance for Referencing of BWRVIP-74 in License Renewal Applications," letter dated October 31, 2001

A.1-7 Nebraska Public Power District, *Cooper Nuclear Station, Plant Unique Analysis Report*, *Mark I Containment Program*, revised February 26, 2007.

A.1-8 Technical Report MPR-751, Mark I Containment Program Augmented Class 2/3 Fatigue Evaluation Method and Results for Typical Torus Attached and SRV Piping Systems, November 1982.

A.1-9 NUREG/CR-6260, *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, February 1995.

A.2 LICENSE RENEWAL COMMITMENTS

The preliminary list of commitments made in the License Renewal Application for Cooper Nuclear Station has been provided in the letter transmitting the LRA to the NRC. The commitments reflect the contents of the LRA as submitted but are considered preliminary in that the specific wording of some commitments may change, and additional commitments may be made, during the NRC review of the LRA. Any other actions discussed in the LRA should be considered intended or planned actions. These other actions are included for informational purposes but are not considered regulatory commitments.

The final commitments as submitted by NPPD, and accepted by NRC, are expected to be confirmed in the NRC's Safety Evaluation Report (SER) for the renewed operating licenses. These final commitments, as confirmed in the SER, will become effective upon NRC issuance of the renewed operating license.

APPENDIX B

AGING MANAGEMENT PROGRAMS AND ACTIVITIES

TABLE OF CONTENTS

B.0 INTRODUCTION

B.0.1 OVERVIEW

The aging management review results for the integrated plant assessment of Cooper Nuclear Station (CNS) are presented in Sections 3.1 through 3.6 of this application. The programs credited in the integrated plant assessment for managing aging effects are described in this appendix.

Each aging management program described in this appendix has ten elements in accordance with the guidance in NUREG-1800 (Reference B.2-1) Appendix A.1, "Aging Management Review – Generic," Table A.1-1, "Elements of an Aging Management Program for License Renewal." For aging management programs that are comparable to the programs described in Sections X and XI of NUREG-1801 (Reference B.2-2), *Generic Aging Lessons Learned (GALL) Report*, the ten elements have been compared to the elements of the NUREG-1801 program. For plant-specific programs that do not correlate with NUREG-1801, the ten elements are addressed in the program description.

B.0.2 FORMAT OF PRESENTATION

For those aging management programs that are comparable to the programs described in Sections X and XI of NUREG-1801, the program discussion is presented in the following format.

- **Program Description**: abstract of the overall program.
- **NUREG-1801 Consistency**: summary of the degree of consistency between the CNS program and the corresponding NUREG-1801 program, when applicable (i.e., degree of similarity, etc.).
- **Exceptions to NUREG-1801**: exceptions to the NUREG-1801 program, including a justification for the exceptions (when applicable).
- **Enhancements**: future program enhancements with a proposed schedule for their completion (when applicable), including additional program features to manage aging effects not addressed by the NUREG-1801 program.
- **Operating Experience**: discussion of operating experience information specific to the program.
- **Conclusion**: statement of reasonable assurance that the program is effective, or will be effective, once implemented with necessary enhancements.

For plant-specific programs, a complete discussion of the ten elements of NUREG-1800 Table A.1-1 is provided.

B.0.3 CORRECTIVE ACTIONS, CONFIRMATION PROCESS AND ADMINISTRATIVE CONTROLS

Three elements common to all aging management programs are corrective actions, confirmation process and administrative controls. Discussion of these elements is presented below. Corrective actions have program-specific details which are included in the descriptions of the individual programs in this report, but further discussion of the confirmation process and administrative controls is not necessary and is not included in the descriptions of the individual programs.

Corrective Actions

CNS quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Conditions adverse to quality, such as failures, malfunctions, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the nonconformance is determined and that corrective action is taken to preclude recurrence. In addition, the root cause of the significant condition adverse to quality and the corrective action implemented are documented and reported to appropriate levels of management. The corrective action controls of the CNS (10 CFR Part 50, Appendix B) Quality Assurance Program are applicable to all aging management programs and activities during the period of extended operation.

Confirmation Process

CNS QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The CNS Quality Assurance Program applies to CNS safety-related structures and components. Corrective actions and administrative (document) control for both safety-related and nonsafety-related structures and components are accomplished per the existing CNS Corrective Action Program and Document Control Program. The confirmation process is part of the Corrective Action Program and includes

- reviews to assure that proposed actions are adequate,
- tracking and reporting of open corrective actions, and
- review of corrective action effectiveness.

Any follow-up inspection required by the confirmation process is documented in accordance with the Corrective Action Program. The Corrective Action Program constitutes the confirmation process for aging management programs and activities. The CNS confirmation process is consistent with NUREG-1801.

Administrative Controls

CNS QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The CNS Quality Assurance Program applies to CNS safety-related structures and components. Administrative (document) control for both safety-related and nonsafety-related structures and components is accomplished per the existing document control program. The CNS administrative controls are consistent with NUREG-1801.

B.0.4 OPERATING EXPERIENCE

Operating experience for the programs and activities credited with managing the effects of aging was reviewed. The operating experience review included a review of corrective actions resulting in program enhancements. For inspection programs, reports of recent inspections, examinations, or tests were reviewed to determine if aging effects have been identified on applicable components. For monitoring programs, reports of sample results were reviewed to determine if parameters are being maintained as required by the program. Also, program owners contributed evidence of program success or weakness and identified applicable self-assessments, QA audits, peer evaluations, and NRC reviews.

Site procedures for evaluating operating experience require reviews of site and relevant industry OE as the site continues operation through the license renewal period.

B.0.5 AGING MANAGEMENT PROGRAMS

Table B-1 lists the aging management programs described in this appendix. Programs are identified as either existing or new. The programs are either comparable to programs described in NUREG-1801 or are plant-specific. The correlation between NUREG-1801 programs and CNS programs is shown in Table B-2.

Table B-1
Aging Management Programs

Program	Section	New or Existing
Aboveground Steel Tanks	B.1.1	new
Bolting Integrity	B.1.2	existing
Buried Piping and Tanks Inspection	B.1.3	new
BWR CRD Return Line Nozzle	B.1.4	existing
BWR Feedwater Nozzle	B.1.5	existing
BWR Penetrations	B.1.6	existing
BWR Stress Corrosion Cracking	B.1.7	existing
BWR Vessel ID Attachment Welds	B.1.8	existing
BWR Vessel Internals	B.1.9	existing
Containment Inservice Inspection	B.1.10	existing
Containment Leak Rate	B.1.11	existing
Diesel Fuel Monitoring	B.1.12	existing
Environmental Qualification (EQ) of Electric Components	B.1.13	existing
External Surfaces Monitoring	B.1.14	existing
Fatigue Monitoring	B.1.15	existing
Fire Protection	B.1.16	existing
Fire Water System	B.1.17	existing
Flow-Accelerated Corrosion	B.1.18	existing
Inservice Inspection–ISI	B.1.19	existing
Inservice Inspection–IWF	B.1.20	existing
Masonry Wall	B.1.21	existing
Metal-Enclosed Bus Inspection Program	B.1.22	new

Table B-1
Aging Management Programs (Continued)

Program	Section	New or Existing
Neutron Absorber Monitoring	B.1.23	existing
Non-EQ Bolted Cable Connections	B.1.24	new
Non-EQ Inaccessible Medium-Voltage Cable	B.1.25	new
Non-EQ Instrumentation Circuits Test Review	B.1.26	new
Non-EQ Insulated Cables and Connections	B.1.27	new
Oil Analysis	B.1.28	existing
One-Time Inspection	B.1.29	new
One-Time Inspection – Small-Bore Piping	B.1.30	new
Periodic Surveillance and Preventive Maintenance	B.1.31	existing
Reactor Head Closure Studs	B.1.32	existing
Reactor Vessel Surveillance	B.1.33	existing
Selective Leaching	B.1.34	new
Service Water Integrity	B.1.35	existing
Structures Monitoring	B.1.36	existing
Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	B.1.37	new
Water Chemistry Control – Auxiliary Systems	B.1.38	existing
Water Chemistry Control – BWR	B.1.39	existing
Water Chemistry Control – Closed Cooling Water	B.1.40	existing

B.0.6 CORRELATION WITH NUREG-1801 AGING MANAGEMENT PROGRAMS

The correlation between NUREG-1801 programs and CNS programs is shown below. For the CNS programs, links to appropriate sections of this appendix are provided.

Table B-2
CNS AMP Correlation with NUREG-1801 Programs

NUREG-1801 Number	NUREG-1801 Program	CNS Program
X.E1	Environmental Qualification (EQ) of Electric Components	Environmental Qualification (EQ) of Electric Components [B.1.13]
X.M1	Metal Fatigue of Reactor Coolant Pressure Boundary	Fatigue Monitoring [B.1.15]
X.S1	Concrete Containment Tendon Prestress	CNS does not have pre-stressed tendons in the containment structures. The NUREG-1801 program does not apply.
XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	Inservice Inspection – ISI [B.1.19]
XI.M2	Water Chemistry	Water Chemistry Control – BWR [B.1.39]
XI.M3	Reactor Head Closure Studs	Reactor Head Closure Studs [B.1.32]
XI.M4	BWR Vessel ID Attachment Welds	BWR Vessel ID Attachment Welds [B.1.8]
XI.M5	BWR Feedwater Nozzle	BWR Feedwater Nozzle [B.1.5]
XI.M6	BWR Control Rod Drive Return Line Nozzle	BWR CRD Return Line Nozzle [B.1.4]
XI.M7	BWR Stress Corrosion Cracking	BWR Stress Corrosion Cracking [B.1.7]
XI.M8	BWR Penetrations	BWR Penetrations [B.1.6]
XI.M9	BWR Vessel Internals	BWR Vessel Internals [B.1.9]
XI.M10	Boric Acid Corrosion	CNS is a BWR. The NUREG-1801 program does not apply.

Table B-2
CNS AMP Correlation with NUREG-1801 Programs (Continued)

NUREG-1801 Number	NUREG-1801 Program	CNS Program
XI.M11	Nickel-Alloy Nozzles and Penetrations	CNS is a BWR. The NUREG-1801 program does not apply.
XI.M11A	Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	CNS is a BWR. The NUREG-1801 program does not apply.
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Not credited for aging management. Refer to the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program. [B.1.37]
XI.M13	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS) [B.1.37]
XI.M14	Loose Part Monitoring	Not credited for aging management.
XI.M15	Neutron Noise Monitoring	Not credited for aging management.
XI.M16	PWR Vessel Internals	CNS is a BWR. The NUREG-1801 program does not apply.
XI.M17	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion Program [B.1.18]
XI.M18	Bolting Integrity	Bolting Integrity [B.1.2]
XI.M19	Steam Generator Tube Integrity	CNS is a BWR. The NUREG-1801 program does not apply.
XI.M20	Open-Cycle Cooling Water System	Service Water Integrity [B.1.35]
XI.M21	Closed-Cycle Cooling Water System	Water Chemistry Control – Closed Cooling Water [B.1.40]

Table B-2
CNS AMP Correlation with NUREG-1801 Programs (Continued)

NUREG-1801 Number	NUREG-1801 Program	CNS Program
XI.M22	Boraflex Monitoring	Spent fuel racks at CNS use "Boral" and "Metamic" as the neutron absorbers (rather than Boraflex). The NUREG-1801 program does not apply.
XI.M23	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Not credited for aging management. The Structures Monitoring Program [B.1.36] and the Periodic Surveillance and Preventive Maintenance Program [B.1.31] manage the effects of aging for crane components.
XI.M24	Compressed Air Monitoring	Not credited for aging management. Programs identified in Section 3.3.2.1.10 manage the effects of aging for compressed air system components.
XI.M25	BWR Reactor Water Cleanup System	Not credited for aging management. Refer to relevant discussion in Table 3.3.1, Item 3.3.1-37.
XI.M26	Fire Protection	Fire Protection [B.1.16]
XI.M27	Fire Water System	Fire Water System [B.1.17]
XI.M28	Buried Piping and Tanks Surveillance	Not credited for aging management. The Buried Piping and Tanks Inspection Program [B.1.3] manages the effects of aging on buried piping and tanks.
XI.M29	Aboveground Steel Tanks	Aboveground Steel Tanks [B.1.1]
XI.M30	Fuel Oil Chemistry	Diesel Fuel Monitoring [B.1.12]
XI.M31	Reactor Vessel Surveillance	Reactor Vessel Surveillance [B.1.33]
XI.M32	One-Time Inspection	One-Time Inspection [B.1.29]
XI.M33	Selective Leaching of Materials	Selective Leaching [B.1.34]

Table B-2
CNS AMP Correlation with NUREG-1801 Programs (Continued)

NUREG-1801 Number	NUREG-1801 Program	CNS Program
XI.M34	Buried Piping and Tanks Inspection	Buried Piping and Tanks Inspection Program [B.1.3]
XI.M35	One-time Inspection of ASME Code Class 1 Small-Bore Piping	One-Time Inspection – Small-Bore Piping [B.1.30]
XI.M36	External Surfaces Monitoring	External Surfaces Monitoring [B.1.14]
XI.M37	Flux Thimble Tube Inspection	CNS is a BWR. The NUREG-1801 program does not apply.
XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Not credited for aging management. The External Surfaces Monitoring Program [B.1.14] or the Periodic Surveillance and Preventive Maintenance Program [B.1.31] manage the effects of aging on internal surfaces of piping and ducting components.
XI.M39	Lubricating Oil Analysis	Oil Analysis [B.1.28]
XI.E1	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Insulated Cables and Connections [B.1.27]
XI.E2	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Non-EQ Instrumentation Circuits Test Review [B.1.26]
XI.E3	Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Inaccessible Medium-Voltage Cable [B.1.25]
XI.E4	Metal Enclosed Bus	Metal-Enclosed Bus Inspection [B.1.22]

Table B-2
CNS AMP Correlation with NUREG-1801 Programs (Continued)

NUREG-1801 Number	NUREG-1801 Program	CNS Program
XI.E5	Fuse Holders	Not credited for aging management. Refer to relevant discussion in Table 3.6.1, Item 3.6.1-6.
XI.E6	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	See Non-EQ Bolted Cable Connections [B.1.24] for an alternative.
XI.S1	ASME Section XI, Subsection IWE	Containment Inservice Inspection [B.1.10]
XI.S2	ASME Section XI, Subsection IWL	CNS does not have a concrete containment. The NUREG-1801 program does not apply.
XI.S3	ASME Section XI, Subsection IWF	Inservice Inspection – IWF [B.1.20]
XI.S4	10 CFR 50, Appendix J	Containment Leak Rate [B.1.11]
XI.S5	Masonry Wall Program	Masonry Wall Program [B.1.21]
XI.S6	Structures Monitoring Program	Structures Monitoring [B.1.36]
XI.S7	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Not credited for aging management. The Structures Monitoring Program [B.1.36] manages the effects of aging on water control structures.
XI.S8	Protective Coating Monitoring and Maintenance Program	Not credited for aging management. The Containment Inservice Inspection Program [B.1.10] manages the effects of aging on the drywell shell.
Plant-Specific Programs		
NA	Plant-specific program	Neutron Absorber Monitoring [B.1.23]
NA	Plant-specific program	Non-EQ Bolted Cable Connections [B.1.24]

Table B-2
CNS AMP Correlation with NUREG-1801 Programs (Continued)

NUREG-1801 Number	NUREG-1801 Program	CNS Program
NA	Plant-specific program	Periodic Surveillance and Preventive Maintenance [B.1.31]
NA	Plant-specific program	Water Chemistry Control – Auxiliary Systems [B.1.38]

Table B-3 indicates the consistency of CNS programs with NUREG-1801 programs.

Table B-3
CNS Program Consistency with NUREG-1801

Program Name	Plant Specific	NUREG-1801 Comparison		
		Consistent with NUREG-1801	Programs with Enhancements	Programs with Exceptions to NUREG-1801
Aboveground Steel Tanks		X		
Bolting Integrity		X	X	
Buried Piping and Tanks Inspection		X		
BWR CRD Return Line Nozzle		X		
BWR Feedwater Nozzle				X
BWR Penetrations		X		
BWR Stress Corrosion Cracking				X
BWR Vessel ID Attachment Welds		X		
BWR Vessel Internals		X	X	

Table B-3
CNS Program Consistency with NUREG-1801 (Continued)

Program Name	Plant Specific	NUREG-1801 Comparison		
		Consistent with NUREG-1801	Programs with Enhancements	Programs with Exceptions to NUREG-1801
Containment Inservice Inspection		X	X	
Containment Leak Rate				X
Diesel Fuel Monitoring			X	X
Environmental Qualification (EQ) of Electric Components		X		
External Surfaces Monitoring		X	X	
Fatigue Monitoring		X	X	
Fire Protection			X	X
Fire Water System			X	X
Flow-Accelerated Corrosion			X	X
Inservice Inspection – ISI				X
Inservice Inspection – IWF			X	X
Masonry Wall		X	X	
Metal-Enclosed Bus Inspection				X
Neutron Absorber Monitoring	X			
Non-EQ Bolted Cable Connections	X			
Non-EQ Inaccessible Medium-Voltage Cable		X		
Non-EQ Instrumentation Circuits Test Review		X		

Table B-3
CNS Program Consistency with NUREG-1801 (Continued)

Program Name	Plant Specific	NUREG-1801 Comparison		
		Consistent with NUREG-1801	Programs with Enhancements	Programs with Exceptions to NUREG-1801
Non-EQ Insulated Cables and Connections		X		
Oil Analysis		X	X	
One-Time Inspection		X		
One-Time Inspection – Small-Bore Piping		X		
Periodic Surveillance and Preventive Maintenance	X			
Reactor Head Closure Studs				X
Reactor Vessel Surveillance		X	X	
Selective Leaching		X		
Service Water Integrity		X		
Structures Monitoring		X	X	
Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)		X		
Water Chemistry Control – Auxiliary Systems	X			
Water Chemistry Control – BWR		X		
Water Chemistry Control – Closed Cooling Water				X

B.1 AGING MANAGEMENT PROGRAMS AND ACTIVITIES

B.1.1 ABOVEGROUND STEEL TANKS

Program Description

The Aboveground Steel Tanks Program is a new program that will manage loss of material from external surfaces of outdoor, aboveground carbon steel tanks by periodic visual inspection of external surfaces and thickness measurement of locations that are inaccessible for external visual inspection.

NUREG-1801 Consistency

The Aboveground Steel Tanks Program will be consistent with the program described in NUREG-1801, Section XI.M29, Aboveground Steel Tanks.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Aboveground Steel Tanks Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the Aboveground Steel Tanks Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The Aboveground Steel Tanks Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Aboveground Steel Tanks Program provides assurance that 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.1.2 BOLTING INTEGRITY

Program Description

The Bolting Integrity Program is an existing program that relies on recommendations for a comprehensive bolting integrity program, as delineated in NUREG-1339, industry recommendations, and Electric Power Research Institute (EPRI) NP-5769, with the exceptions noted in NUREG-1339 for safety-related bolting. The program relies on industry recommendations for comprehensive bolting maintenance, as delineated in EPRI TR-104213 for pressure retaining bolting and structural bolting.

The program applies to bolting and torquing practices of safety- and nonsafety-related bolting for pressure retaining components, NSSS component supports, and structural joints. The program addresses all bolting regardless of size except reactor head closure studs, which are addressed by the Reactor Head Closure Studs Program [B.1.32]. The program includes periodic inspection of closure bolting for signs of leakage that may be due to crack initiation, loss of preload, or loss of material due to corrosion. The program also includes preventive measures to preclude or minimize loss of preload and cracking.

NUREG-1801 Consistency

The Bolting Integrity Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M18, Bolting Integrity.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancement
1. Scope of Program	The Bolting Integrity Program will be enhanced to include guidance from EPRI NP-5769 and EPRI TR-104213 for material selection and testing, bolting preload control, ISI, plant operation and maintenance, and evaluation of the structural integrity of bolted joints.

Elements Affected	Enhancement
2. Preventive Actions	The Bolting Integrity Program will be enhanced to clarify that actual yield strength is used in selecting materials for low susceptibility to SCC, to clarify the prohibition on use of lubricants containing MoS_2 for bolting at CNS, and to specify that proper gasket compression will be visually verified following assembly.
7. Corrective Actions	The Bolting Integrity Program will be enhanced to include guidance from EPRI NP-5769 and EPRI TR-104213 for replacement of non-Class 1 bolting and disposition of degraded structural bolting.

Operating Experience

Corroded bolting and fasteners were identified in 2005 in the auxiliary steam and service water systems and in 2006 in the radwaste (Z sump for plant drains) system. Bolting was replaced on the valve in the auxiliary steam system. Corrosion on bolting in the service water system was removed and the bolting was painted with corrosion preventive material. The corrosion on the fasteners in the Z sump was evaluated as superficial and did not compromise structural integrity.

In 2003 and 2005, VT-1 inspections were completed of the drywell head fasteners. In 2003 numerous recordable conditions such as arc strikes, necking, washer gouging, galling on bolt shafts and “machining” chatter on threads were noted. Evaluation of these conditions indicated that only the bolts subject to arc strike, necking and “machining” chatter required replacement. Gouged washers and galled bolts were determined acceptable “as-is.” Inspections of drywell head fasteners in 2005 indicated only a gouged washer that required replacement.

In 2003 steam leakage from a flanged connection was noted during in-service leak testing. This leakage was corrected by additional torquing on the flange in accordance with plant procedures.

In 2002 personnel identified an apparent increase in steam leakage from the moisture separator manways. Evaluation determined that bolt lubricant had been applied to newly specified gaskets with non-asbestos materials as well as to the bolting. The gasket vendor indicated that the bolt lubricant had a deleterious effect on the new gaskets. Gaskets that were subject to this condition were replaced and maintenance procedures were revised to assure the bolt lubricant was not used on the gaskets.

The Bolting Integrity Program has been effective in identification of conditions and program deficiencies. Appropriate corrective actions have been implemented to correct program deficiencies and to ensure future integrity of the bolted connections. This provides assurance that the program will remain effective for managing loss of material. The history of identification of degradation and initiation of corrective action prior to loss of intended function provide assurance that the program is effective for managing aging effects for passive components.

Conclusion

The Bolting Integrity Program has been effective at managing aging effects. The Bolting Integrity Program assures 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.1.3 BURIED PIPING AND TANKS INSPECTION

Program Description

The Buried Piping and Tanks Inspection Program is a new program that will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, gray cast iron, and stainless steel components. Preventive measures will be in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components will be inspected when excavated during maintenance. If trending within the Corrective Action Program identifies susceptible locations, the areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement.

Prior to entering the period of extended operation, plant operating experience will be reviewed to verify that an inspection occurred within the past ten years. If an inspection did not occur, a focused inspection will be performed prior to the period of extended operation. A focused inspection will be performed within the first ten years of the period of extended operation, unless an opportunistic inspection occurs within this ten-year period. A “focused inspection” is defined as an inspection performed in areas with a history of corrosion problems and in areas with the highest likelihood of corrosion problems.

This program will be implemented prior to the period of extended operation.

NUREG-1801 Consistency

The Buried Piping and Tanks Inspection Program will be consistent with the program described in NUREG-1801, Section XI.M34, Buried Piping and Tanks Inspection.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Buried Piping and Tanks Inspection Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the Buried Piping and Tanks Inspection Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The Buried Piping and Tanks Inspection Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Buried Piping and Tanks Inspection Program provides assurance that 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.1.4 BWR CRD RETURN LINE NOZZLE

Program Description

The BWR Control Rod Drive (CRD) Return Line Nozzle Program is an existing program.

Under this program, CNS has cut and capped the CRD return line nozzle to mitigate fatigue cracking and continues Inservice Inspection (ISI) examinations using ASME Section XI to monitor the effects of crack initiation and growth on the intended function of the control rod drive return line nozzle. ISI examinations include ultrasonic inspection of the nozzle inside radius section and nozzle-to-vessel weld. CNS also conducts UT examinations of the CRD return line nozzle-to-cap weld in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) document BWRVIP-75-A as part of the BWR Stress Corrosion Cracking Program [B.1.7].

NUREG-1801 Consistency

The BWR CRD Return Line Nozzle Program is consistent with the program described in NUREG-1801, Section XI.M6, BWR Control Rod Drive Return Line Nozzle.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

During RE22 in 2005 the control rod drive return line nozzle inner radius weld and the nozzle-to-shell weld were ultrasonically examined and found acceptable. Absence of aging effects indicates that the preventive actions of the program have been effective.

The CRD Return Line Nozzle Program detects aging effects using nondestructive examination visual, surface 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. In addition, BWRVIP-75-A is based on industry-wide experience at BWR plants. The application of these proven methods provides assurance that the effects of aging will be managed such that the CRD return line nozzle components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Conclusion

The BWR CRD Return Line Nozzle Program has been effective at managing aging effects. The BWR CRD Return Line Nozzle Program assures 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.1.5 BWR FEEDWATER NOZZLE

Program Description

The BWR Feedwater Nozzle Program is an existing program.

Under this program, CNS has removed feedwater nozzle cladding and installed a double piston ring, triple thermal sleeve sparger to mitigate cracking. This program implements enhanced inservice inspection (ISI) of the feedwater nozzles in accordance with the requirements of ASME Section XI, Subsection IWB and the recommendation of General Electric (GE) NE 523-A71-0594-A to detect cracking.

NUREG-1801 Consistency

The BWR Feedwater Nozzle Program is consistent with the program described in NUREG-1801, Section XI.M5, BWR Feedwater Nozzle, with one exception.

Exceptions to NUREG-1801

The BWR Feedwater Nozzle Program is consistent with the program described in NUREG-1801, Section XI.M5, BWR Feedwater Nozzle, with the following exception.

Elements Affected	Exceptions
2. Preventive Actions	NUREG-1801 recommends performing low-flow modifications of the feedwater control system and rerouting of the reactor water cleanup (RWCU) system as recommended in NUREG-0619. CNS has not performed these modifications and rerouting.[1]

Exception Note

1. These modifications were recommended in NUREG-0619 to decrease the magnitude and frequency of temperature fluctuations and thus prevent crack initiation and limit crack growth, thereby permitting an extension of the time between required inspections. At that time, CNS accepted the NUREG-0619 inspection intervals, without extension, since the existing feedwater flow control system was found to provide satisfactory low-flow control and rerouting of the RWCU system was not necessary due to the low ratio of RWCU flow to feedwater flow. Thus, the low-flow and RWCU modifications were not necessary. Subsequently, GE-NE-523-A71-0594-A was approved in which the use of modern UT techniques coupled with plant-specific fracture mechanics assessments that utilize actual plant thermal cycle duty negated the need for NUREG-0619 penetrant test examinations and permitted reduction of the NUREG-0619 UT exam frequency. The CNS feedwater nozzle fracture mechanics analysis (without low-flow and RWCU modifications) supports an examination schedule of one examination each inspection

interval consistent with ASME Section XI. Since inspections to monitor for crack initiation and growth will continue per ASME Section XI, the low-flow and RWCU modifications are not necessary to assure that the feedwater nozzles can perform their intended function consistent with the current licensing basis through the period of extended operation.

Enhancements

None

Operating Experience

Reactor pressure vessel inner radius section ultrasonic examinations were performed for nozzles N4A, N4B, N4C and N4D in 2005 during RE22. No indications that required evaluation were recorded during these examinations. Absence of aging effects indicates that the preventive actions of the program have been effective.

The BWR Feedwater Nozzle Program detects aging effects using nondestructive examination (NDE) visual, surface 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. The application of these proven methods provides assurance that the effects of aging will be managed such that the BWR feedwater nozzle components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Conclusion

The BWR Feedwater Nozzle Program has been effective at managing aging effects. The BWR Feedwater Nozzle Program assures 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.1.6 BWR PENETRATIONS

Program Description

The BWR Penetrations Program is an existing program that includes (a) inspection and flaw evaluation in conformance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) documents BWRVIP-27-A and BWRVIP-49-A and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel penetrations and nozzles.

NUREG-1801 Consistency

The BWR Penetrations Program is consistent with the program described in NUREG-1801, Section XI.M8, BWR Penetrations.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The nozzle-to-safe-end welds of instrument nozzle 16B1 and SLC nozzle N10 were ultrasonically examined and found acceptable in 2005 during RE22. Each of the instrument penetration nozzles (N11A/B, N12A/B, and N16A/B) were inspected and found acceptable during pressure testing in RE21 in 2003 and RE23 in 2005. Absence of aging effects indicates that the preventive actions of the program have been effective.

The BWR Penetrations Program detects aging effects using nondestructive examination visual, surface 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. In addition, the BWRVIP programs are based on industry-wide experience at BWR plants. The application of these proven methods provides assurance that the effects of aging will be managed such that the BWR Penetrations Program components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Conclusion

The BWR Penetrations Program has been effective at managing aging effects. The BWR Penetrations Program assures 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.1.7 BWR STRESS CORROSION CRACKING

Program Description

The BWR Stress Corrosion Cracking Program is an existing program that includes (a) preventive measures to mitigate intergranular stress corrosion cracking (IGSCC), and (b) inspection and flaw evaluation to monitor IGSCC and its effects on reactor coolant pressure boundary components made of stainless steel, CASS, or nickel alloy. CNS has taken actions to prevent IGSCC and will continue to use materials resistant to IGSCC for component replacements and repairs following the recommendations delineated in NUREG-0313, Generic Letter 88-01, Generic Letter 88-01 Supplement 1, and the staff-approved BWRVIP-75-A report. Inspection of piping identified in NRC Generic Letter 88-01 to detect and size cracks is performed in accordance with the staff positions on schedule, method, personnel qualification and sample expansion included in the generic letter and the staff-approved BWRVIP-75-A report.

NUREG-1801 Consistency

The BWR Stress Corrosion Cracking Program is consistent with the program described in NUREG-1801, Section XI.M7, BWR Stress Corrosion Cracking, with one exception.

Exceptions to NUREG-1801

The BWR Stress Corrosion Cracking Program is consistent with the program described in NUREG-1801, Section XI.M7, BWR Stress Corrosion Cracking with the following exception.

Elements Affected	Exception
4. Detection of Aging Effects 5. Monitoring and Trending	NUREG-1801 recommends the use of GL 88-01 to determine the scope of welds selected for examination. CNS also bases this scope on risk informed methodology approved by NRC.[1]

Exception Notes

1. Significant industry attention has been devoted to the application of risk-informed selection criteria in order to determine the scope of inservice inspection programs at nuclear power plants. CNS applied the methodology documented in the NRC-approved EPRI Topical Report TR-112657 in the development of the CNS Risk-Informed Inservice Inspection (RI-ISI) Program. Although the use of this methodology for the selection and subsequent examination of Class 1 piping welds creates a different inspection schedule for GL 88-01 Category A welds than that delineated in NRC GL 88-01 or BWRVIP-75-A, it provides an acceptable level of quality and safety. This alternative to the ASME code has been approved in accordance with the provisions of 10 CFR 50.55a(a)(3) for the 4th interval. To continue the alternative in subsequent intervals during the period of extended operation, approval must be obtained in accordance with 10 CFR 50.55a.

Enhancements

None

Operating Experience

In 2000 during RE19, safe end nozzles and piping components were ultrasonically examined and found acceptable. Examinations during RE19 in 2000 and RE22 in 2005 for a nozzle cap had recordable indications, which were caused by ID geometry and determined to be acceptable. Absence of aging effects indicates that the preventive actions of the program have been effective.

The BWR Stress Corrosion Cracking Program detects aging effects using nondestructive examination (NDE) visual, surface 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. In addition, BWRVIP-75-A is based on industry-wide experience at BWR plants. The application of these proven methods provides assurance that the effects of aging will be managed such that the BWR Stress Corrosion Cracking Program components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Conclusion

The BWR Stress Corrosion Cracking Program has been effective at managing aging effects. The BWR Stress Corrosion Cracking Program assures 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.1.8 BWR VESSEL ID ATTACHMENT WELDS

Program Description

The BWR Vessel ID Attachment Welds Program is an existing program that includes (a) inspection and flaw evaluation in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) BWRVIP-48-A and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 (EPRI Report 1008192) to ensure the long-term integrity and safe operation of reactor vessel inside diameter (ID) attachment welds and support pads.

NUREG-1801 Consistency

The BWR Vessel ID Attachment Welds Program is consistent with the program described in NUREG-1801, Section XI.M4, BWR Vessel ID Attachment Welds.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

In 2000 during RE19 and 2003 during RE21, a combination of components including guide rod brackets, feedwater sparger brackets, and core spray sparger brackets was examined with no recordable indications for the guide rod and feedwater sparger brackets. Indications found in 2000 during RE19 on the core spray sparger brackets were determined to be acceptable.

In 2003 during RE21, jet pump riser brace attachment pad welds and steam dryer support brackets were examined with no indications.

In 2005 during RE22, holddown brackets for the surveillance specimens and steam dryer were examined with no indications. The jet pump riser brace attachment was also examined with no indications. Absence of aging effects indicates that the preventive actions of the program have been effective.

The BWR Vessel ID Attachment Welds Program detects aging effects using nondestructive examination (NDE) visual, surface 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. In addition, BWRVIP-48 is based on industry-wide experience at BWR plants. The application of these proven methods provides assurance that the effects of aging will be managed such that the BWR Vessel ID Attachment Welds Program components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Conclusion

The BWR Vessel ID Attachment Welds Program has been effective at managing aging effects. The BWR Vessel ID Attachment Welds Program assures 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.1.9 BWR VESSEL INTERNALS

Program Description

The BWR Vessel Internals Program is an existing program that includes (a) inspection, flaw evaluation, and repair in conformance with the applicable, staff-approved BWR reactor vessel and internals project (BWRVIP) documents and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel internal components. In addition, the BWR Vessel Internals Program includes inspection of the steam dryer in accordance with BWRVIP-139 guidance.

NUREG-1801 Consistency

The BWR Vessel Internals Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M9, BWR Vessel Internals.

Exceptions to NUREG-1801

None

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
1. Scope of Program	In addition to the scope of program described in NUREG-1801, CNS scope of program will include actions to replace the plugs in the core plate bypass holes based on their qualified life.

Operating Experience

In 2000 during RE19, the core spray sparger and brackets were inspected. Five indications were dispositioned as acceptable. In 2001 additional welds were examined with no indications. In 2003 welds were examined, including some of the same welds examined in 2001 and found no indications. In 2006 welds were examined with no indications observed.

In 2000 during RE19, a combination of vessel internal components was examined with no recordable indications with the exception of the core spray piping. Indications in the core spray piping were reexamined as they have been since 1995 during each pursuant outage. These indications have been evaluated as acceptable in each case. Indications were found in the core spray "B" loop piping in RE20. The weld was re-examined in RE21, and no new indications were found. The weld was re-examined in RE23 and evaluated as acceptable.

Two indications were found in 2006 on the top guide pin keeper. These indications were evaluated as acceptable.

In 2006 during RE23, top guide aligner pins, steam dryer lifting lugs, core shroud welds, and core spray welds were examined. These examinations showed indications that were evaluated as acceptable. Absence of aging effects indicates that the preventive actions of the program have been effective.

In 2006, a QA surveillance reviewed condition reports initiated during the past two years related to vessel internals inspections. This review identified improvements in the BWRVIP program such as better handling of deviation dispositions for deferred inspections and more timely completion of inspections. CNS inspection commitments were found to be up-to-date and in compliance with BWRVIP requirements. No conditions adverse to quality were identified during this surveillance.

The BWR Vessel Internals Program detects aging effects using nondestructive examination (NDE) visual, surface 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. In addition, the various BWRVIPs applied in this program are based on industry-wide experience at BWR plants. The application of these proven methods provides assurance that the effects of aging will be managed such that the BWR Internals Program components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Conclusion

The BWR Vessel Internals Program has been effective at managing aging effects. The BWR Vessel Internals Program assures 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.1.10 CONTAINMENT INSERVICE INSPECTION

Program Description

The Containment Inservice Inspection Program is an existing program that manages loss of material and cracking for the primary containment and its integral attachments. The program uses the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition, through the 2003 Addenda.

Visual inspections for IWE monitor loss of material of the steel containment shells and their integral attachments; containment hatches and airlocks; moisture barriers; and pressure-retaining bolting by inspecting surfaces for evidence of flaking, blistering, peeling, discoloration, and other signs of distress.

NUREG-1801 Consistency

The Containment Inservice Inspection Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S1, ASME Section XI, Subsection IWE.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
4. Detection of Aging Effects	For surface areas requiring augmented examination, guidance will be provided in CNS CII Program to require accessible areas to be examined using a visual examination method and surface areas not accessible on the side requiring augmented examination to be examined using an ultrasonic thickness measurement method in accordance with IWE-2500(b).

Elements Affected	Enhancements
6. Acceptance Criteria	For volumetric inspections, guidance will be provided in the CNS CII Program to document material loss in a local area exceeding 10% of the nominal containment wall thickness or material loss in a local area projected to exceed 10% of the nominal containment wall thickness before the next examination in accordance with IWE-3511.3 for volumetric inspections.

Operating Experience

In 2005 inspection of the torus found pitting that was screened for further review. CNS engineering's review indicated that the pitting did not exceed code allowables. The area containing the pitting was recoated.

Results of the Containment Inservice Inspection Program general visual walkdown of primary containment during RE19 in 2000 recorded crack-like indications on gusset plates, arc strikes on the drywell upper bulb, and holes due to burn through from attachment welds. These indications were evaluated as acceptable or repaired with further reexamination.

Results of the Containment Inservice Inspection Program general visual walkdown of primary containment during the mid-cycle outage of 2001 recorded numerous examples of tiger striping, pinpoint rusting, random pitting, uniform corrosion, discoloration, small areas of mechanical damage, general corrosion, and areas of uniform corrosion. The conditions noted were evaluated when they exceeded given screening criteria for evaluation. Upon evaluation, conditions that exceeded the screening criteria for recoat were recoated. None of the conditions exceeded code allowables. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

A self-assessment of the program in 2005 confirmed that the program met regulatory requirements and industry standards. The results of this assessment were used to develop the program changes in preparation for the next 10-year interval. Identification of areas for improvement, and subsequent corrective actions, assures that the program will remain effective for managing aging effects of components.

The Containment Inservice Inspection Program detects aging effects using nondestructive examination visual surface techniques to detect and characterize flaws. Also, the Containment Inservice Inspection Program makes provision to use volumetric examination 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. Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components. The application of these proven 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.

Conclusion

The Containment Inservice Inspection Program has been effective at managing aging effects. The Containment Inservice Inspection Program assures 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.1.11 CONTAINMENT LEAK RATE

Program Description

The Containment Leak Rate Program is an existing program. As described in 10 CFR Part 50, Appendix J, containment leak rate tests are required to assure that (a) leakage through reactor containment and systems and components penetrating containment shall not exceed allowable values specified in technical specifications or associated bases and (b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of containment, and systems and components penetrating containment. The program utilizes 10 CFR 50 Appendix J, Option B, and the guidance in NRC Regulatory Guide 1.163 and NEI 94-01.

NUREG-1801 Consistency

The Containment Leak Rate Program is consistent with the program described in NUREG-1801, Section XI.S4, 10 CFR Part 50, Appendix J, with exceptions.

Exceptions to NUREG-1801

The Containment Leak Rate Program is consistent with the program described in NUREG-1801, Section XI.S4, 10 CFR Part 50, Appendix J with the following exceptions.

Elements Affected	Exception
5. Monitoring and Trending	NUREG-1801 recommends testing in accordance with 10 CFR Part 50, Appendix J, paragraph III.C.1, which requires Type C tests to be performed by local pressurization and applied in the same direction as that when the valve would be required to perform its safety function. CNS performs reverse direction local leak rate testing of four containment isolation valves.[1]
5. Monitoring and Trending	NUREG-1801 recommends testing in accordance with 10 CFR Part 50, Appendix J, paragraphs III.B.2 and III.C.2, which require testing on containment isolation valves (Type C test) and containment penetrations (Type B test), respectively, at peak calculated containment pressure. CNS performs MSIV testing at 29 psig and expansion bellows testing at 5 psig.[2]

Elements Affected	Exception
6. Acceptance Criteria	NUREG-1801 recommends testing in accordance with 10 CFR Part 50, Appendix J, sections III.A and III.B, which require tests to measure an overall containment integrated leak rate and to measure local leakage rates at pressure retaining boundaries and isolation valves, respectively. CNS excludes the main steam isolation valve leakage contributions from the overall integrated leakage rate Type A test measurement and from the sum of the leakage rates from Type B and Type C tests.[3]

Exception Notes

1. CNS has been granted an exemption from 10 CFR Part 50, Appendix J to allow reverse direction local leak rate (Type C) testing of four containment isolation valves since the disk seat is conservatively tested by reverse-direction testing and the leak-tightness of the bonnet and packing boundaries is reasonably assured by other means including the Type A integrated leak rate testing.
2. CNS has been granted an exemption from 10 CFR Part 50, Appendix J to allow MSIV testing at 29 psig and expansion bellows testing at 5 psig between the plies. Since the test procedure results in reverse loading of the inboard MSIV and a greater measured leak rate, testing at 29 psig results in a conservative determination of leak rate through the valves. Since the design of the expansion bellows does not permit local testing at a higher pressure, the bellows are a static system with no moving parts or active components, and the bellows are tested as part of the integrated leak rate test, local testing at 5 psig is acceptable.
3. NRC approved Amendment 226 to Facility Operating License DPR-46 allowing this exemption from the requirements of Sections III.A and III.B of 10 CFR 50 Appendix J, Option B because a separate radiological consequence term has been provided for these pathways. The revised design basis radiological consequences analyses address leakage through these pathways as individual factors, exclusive of the primary containment leakage.

Enhancements

None

Operating Experience

During the local leak rate testing of primary containment in 2003 and 2005, test data met applicable test acceptance criteria and confirmed the structural integrity of the containment. The local leak rate testing in 2006 met test acceptance criteria with the exception of an electrical penetration that did not meet administrative limits. This penetration was repaired and retested as acceptable. This indicates that the program is effective at identifying and managing the effects of loss of material and cracking on primary containment components. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for components.

A QA audit in 2005 and a self-assessment in 2003 revealed no issues or findings that called into question the effectiveness of the program. Reviews against established program standards provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Containment Leak Rate Program has been effective at managing aging effects. The Containment Leak Rate Program assures 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.1.12 DIESEL FUEL MONITORING

Program Description

The Diesel Fuel Monitoring Program is an existing program that entails sampling to ensure that adequate diesel fuel quality is maintained to prevent loss of material in fuel systems. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic sampling and analysis, draining and cleaning of tanks, and verifying the quality of new fuel oil before its introduction into the storage tanks.

Sampling and analysis activities are in accordance with technical specifications for fuel oil purity and the guidelines of ASTM Standards ASTM D4057 and D975.

The One-Time Inspection Program [B.1.29] describes inspections planned to verify that the Diesel Fuel Monitoring Program has been effective at managing aging effects.

NUREG-1801 Consistency

The Diesel Fuel Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M30, Fuel Oil Chemistry Program, with exceptions.

Exceptions to NUREG-1801

The Diesel Fuel Monitoring Program is consistent with the program described in NUREG-1801, Section XI.M30, Fuel Oil Chemistry Program, with the following exceptions.

Elements Affected	Exceptions
1. Scope of Program	NUREG-1801 recommends use of ASTM Standards D2276 and D6217. Particulate testing is performed using the guidelines of ASTM Standard D2276. [1]
1. Scope of Program 3. Parameters Monitored or Inspected 6. Acceptance Criteria	NUREG-1801 recommends use of ASTM Standards D1796 and D2709. Only ASTM Standard D1796 is used for testing water and sediment.[2]
3. Parameters Monitored or Inspected 6. Acceptance Criteria	NUREG-1801 recommends use of modified ASTM Standard D2276 Method A. Determination of particulates is according to non-modified ASTM Standard D2276 Method A.[3]

Exception Notes

1. Particulate testing is performed using standard D2276. The guidelines of D2276 are appropriate for determination of particulates and the plant technical specifications specify this standard.
2. The guidelines of ASTM Standard D1796 are used rather than those of ASTM Standard D2709 (water and sediment by centrifuge for lower viscosities). The two standards are applicable to oils of different viscosities. Standard D1796 is applicable to the fuel oil used at CNS.
3. Determination of particulates is according to non-modified ASTM Standard D2276 Method A which conducts particulate analysis using a 0.8 micron filter, rather than the 3.0 micron filter specified in NUREG-1801. Use of a filter with a smaller pore size results in a larger sample of particulates since smaller particles are retained. Thus, use of a 0.8 micron filter is more conservative than use of the 3.0 micron filter specified in NUREG-1801. Furthermore, ASTM D6217 applies to middle distillate fuel using a smaller volume of sample passing over the 0.8 micron filter. Since ASTM D2276 determines particulates with a larger volume passing through the filter for a longer time than the D6217 method, use of D2276 only is more conservative.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
1. Scope of Program 3. Parameters Monitored or Inspected 6. Acceptance Criteria	The Diesel Fuel Monitoring Program will be revised to use ASTM Standard D4057 for sampling of the diesel fire pump fuel oil storage tank.
2. Preventive Actions	The Diesel Fuel Monitoring Program will be enhanced to include periodic visual inspections and cleaning of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank.
4. Detection of Aging Effects	The Diesel Fuel Monitoring Program will be enhanced to include periodic multilevel sampling of the diesel fuel oil day tanks and the diesel fire pump fuel oil storage tank and to include periodic visual inspections as well as ultrasonic bottom surface thickness measurement of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank.

Elements Affected	Enhancements
6. Acceptance Criteria	The Diesel Fuel Monitoring Program will be enhanced to provide the acceptance criterion of ≤ 10 mg/l for the determination of particulates in the diesel fire pump fuel oil storage tank.
6. Acceptance Criteria	The Diesel Fuel Monitoring Program will be enhanced to specify acceptance criterion for UT thickness measurements of the bottom surfaces of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank.

Operating Experience

In 2005, sampling of diesel oil storage tank B indicated excessive water in the tank. Further evaluation resulted in sample point changes, addition of dewatering drains, and procedural changes to assure proper sampling and drainage for an interim tanker maintained on site and incoming diesel fuel tanker shipments, as well as the other fuel storage tanks on site. Diesel oil storage tank B was dewatered to within acceptance criteria.

In 2005 and 2006 water was detected in samples from the diesel oil storage tank B. Further testing was done and evaluation of the results indicated that water content was within acceptance criteria. Procedures were revised to clarify testing methods.

Several incoming tankers of diesel fuel oil were rejected after testing indicated that they did not meet acceptance criteria in the period 2002 through 2005. These tankers were deferred for further testing, properly filtered prior to offload to meet acceptance criteria or returned to the origination point. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for carbon steel components.

In 2003, industry operating experience indicated evidence of corrosion in diesel fuel storage tanks and was reviewed for applicability at CNS. Corrosion was found at CNS during cleaning activities. Evaluation of the corrosion confirmed that minimum wall thickness was maintained. Corrective actions included the addition of a corrosion inhibitor lining.

Identification of program deficiencies and subsequent corrective actions provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Diesel Fuel Monitoring Program has been effective at managing aging effects. The Diesel Fuel Monitoring Program assures 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.1.13 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRIC COMPONENTS

Program Description

The Environmental Qualification (EQ) of Electric Components Program is an existing program. The Nuclear Regulatory Commission (NRC) has established nuclear station environmental qualification (EQ) requirements in 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49. 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 a loss of coolant accident [LOCA], high energy line breaks [HELBs] or high radiation) are qualified to perform their safety function in those harsh environments. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification.

The CNS EQ program manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components are refurbished, replaced, or their qualification is extended prior to reaching the aging limits established in the evaluation. Some aging evaluations for EQ components are time-limited aging analyses (TLAAs) for license renewal.

EQ Component Reanalysis Attributes

The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of an EQ program. While a component life limiting condition may be due to thermal, radiation, or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized). The reanalysis of an aging evaluation is documented according to the station's quality assurance program requirements that require the verification of assumptions and conclusions. As already noted, important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed below.

Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those applied during the prior evaluation. The Arrhenius methodology is an acceptable thermal model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (that is, normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, one acceptable method of establishing the 60-year normal radiation dose is to multiply the 40-year normal radiation dose by 1.5 (that is, 60 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For cyclical aging, a similar approach may be used. 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, cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Temperature data used in an aging evaluation is to be conservative and based on plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for Technical Specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurements are conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation, or (b) using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to material activation energy values as part of a reanalysis are to be justified on a plant-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used for radiation and cyclical aging.

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 that may include changes to the qualification bases and conclusions.

Acceptance Criteria and Corrective Actions: The reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component is to be refurbished, replaced, or requalified 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 requalify the component if the reanalysis is unsuccessful).

NUREG-1801 Consistency

The Environmental Qualification (EQ) of Electric Components Program is consistent with the program described in NUREG-1801, Section X.E1, Environmental Qualification (EQ) of Electric Components.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Environmental Qualification (EQ) Program at CNS is routinely audited to ensure that program elements are carried out properly. A 2004 QA audit provided a wide view of program-related operating experience, with a focus on certain program elements.

Scope and Preventive Actions: Translation of design criteria into working documents was found to be performed satisfactorily. This included establishment of design basis accident (DBA) margins, calculations of station environmental qualification parameters, use of equipment qualification data packages (EQDPs) to establish qualified life for components, use of maintenance tasks to ensure that components are maintained within their qualified life. Modification activities involving EQ components were found to be satisfactorily conducted in accordance with station processes and procedures.

Acceptance Criteria: No exceptions or deviations from approved codes and standards were observed during a review of EQ design and licensing documents. This provides assurance that acceptance criteria from appropriate standards are specified and included in design documents.

Corrective Actions: Corrective actions taken to prevent recurrence of significant conditions were found to be effective, based on a review of significant condition reports (SCRs) related to the EQ Program.

Providing the proper requirements for the environmental qualification of electrical equipment important to safety, along with the identification of qualified life and specific maintenance/ installation requirements, ensures that the program will remain effective for managing aging effects.

Conclusion

The Environmental Qualification (EQ) of Electric Components Program has been effective at managing aging effects by maintaining equipment within its qualification basis. The Environmental Qualification (EQ) of Electric Components Program assures 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.1.14 EXTERNAL SURFACES MONITORING

Program Description

The External Surfaces Monitoring Program is an existing program that inspects external surfaces of components subject to aging management review. The program is also credited with managing loss of material from internal surfaces for situations in which internal and external material and environment combinations are the same such that external surface condition is representative of internal surface condition. This program does not manage aging effects on structures.

Surfaces that are inaccessible during plant operations are inspected during refueling outages. Surfaces that are insulated are inspected when the external surface is exposed (i.e., during maintenance). Surfaces are inspected at frequencies to assure the effects of aging are managed such that applicable components will perform their intended function during the period of extended operation.

NUREG-1801 Consistency

The External Surfaces Monitoring Program, with enhancement, is consistent with the program described in NUREG-1801, Section XI.M36, External Surfaces Monitoring.

Exceptions to NUREG-1801

None

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Elements Affected	Enhancement
1. Scope of Program	External Surfaces Monitoring Program guidance documents will be enhanced to clarify that periodic inspections of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3) will be performed. Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(2).

Operating Experience

System walkdowns in 2002, 2003, 2004, and 2005 identified evidence of aging effects, such as external valve leakage and leakage at heat exchanger flanges and general corrosion on pipe fittings and flanges. The conditions were low in significance, involving no loss of intended function. Corrective actions were accomplished in accordance with the Corrective Action Program. These examples of the identification of degradation and initiation of corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for passive components.

System walkdowns in 2007 for the condensate filter demineralizer, high pressure coolant injection (HPCI), main steam, reactor core isolation cooling, residual heat removal, and service water systems indicated no evidence of corrosion or leakage except for one inspection on the HPCI system, which showed leakage on the turbine casing.

Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for passive components.

Conclusion

The External Surfaces Monitoring Program has been effective at managing aging effects. The External Surfaces Monitoring Program assures 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.1.15 FATIGUE MONITORING

Program Description

The Fatigue Monitoring Program is an existing program that tracks the number of critical thermal and pressure transients for selected reactor coolant system components, in order not to exceed design limits on fatigue usage. The program ensures the validity of analyses that explicitly assumed a fixed number of thermal and pressure transients by assuring that the actual effective number of transients does not exceed the assumed limit.

This program also addresses the effects of the coolant environment on component fatigue life by assessing the impact of the reactor coolant environment on a sample of critical components for the plant.

NUREG-1801 Consistency

The Fatigue Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section X.M1, Metal Fatigue of Reactor Coolant Pressure Boundary.

Exceptions to NUREG-1801

None

Enhancement

The following enhancements will be implemented at least two years prior to entering the period of extended operation.

Elements Affected	Enhancement
2. Preventive Actions 4. Detection of Aging Effects 6. Acceptance Criteria 7. Corrective Actions	Consideration of the effect of the reactor water environment will be accomplished through implementation of one or more of the following options for the feedwater nozzles, core spray nozzles and RHR pipe transition. (1) Update the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment. This includes applying the appropriate F_{en} factors to valid CUFs determined using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). (2) Repair or replace the affected locations before exceeding a CUF of 1.0.

Elements Affected	Enhancement
3. Parameters Monitored or Inspected	The CNS Fatigue Monitoring Program will be enhanced to require the recording of each transient associated with the actuation of a safety/relief valve (SRV).

Operating Experience

Transient data collected and trended from 2000 through 2005 at CNS confirmed that the number of cycles was not trending toward exceeding the allowable number of cycles. The program continues to monitor plant transients to assure fatigue usage factors are not exceeded.

Operating experience shows that the Fatigue Monitoring Program has been effective in managing aging effects.

Conclusion

The Fatigue Monitoring Program has been demonstrated to maintain the validity of the fatigue design basis for reactor coolant system components designed to withstand the effects of cyclic loads due to reactor system transients.

The Fatigue Monitoring Program assures the fatigue design basis is maintained such that applicable components will continue to perform their intended function consistent with the current licensing basis through the period of extended operation.

B.1.16 FIRE PROTECTION

Program Description

The Fire Protection Program is an existing program that includes a fire barrier inspection and a diesel-driven fire pump inspection. The fire barrier inspection requires periodic visual inspection of fire barrier penetration seals, fire dampers, fire stops, fire wraps, 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 diesel-driven fire pump inspection requires that the pump and its driver be periodically tested and inspected to ensure that diesel engine fuel supply lines can perform their intended functions.

The Fire Protection Program also includes periodic inspection and testing of the CO_2 and Halon fire suppression systems.

NUREG-1801 Consistency

The Fire Protection Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M26, Fire Protection, with an exception.

Exceptions to NUREG-1801

The Fire Protection Program is consistent with the program described in NUREG-1801, Section XI.M26, Fire Protection, with the following exception.

Elements Affected	Exceptions
3. Parameters Monitored or Inspected 4. Detection of Aging Effects	The NUREG-1801 program recommends that functional testing and inspection of the Halon and CO_2 fire suppression systems occur at least once every six months. However, while CNS performs visual inspections at least once every six months, functional testing is performed on an 18-month basis as listed in the current licensing basis for CNS.[1]

Exception Notes

1. The NRC Staff, as documented in the SER for Oyster Creek, has accepted the position that, in the absence of aging-related events adversely affecting system operation and provided that visual inspections of component external surfaces are performed every six months, the periodicity specified in the current licensing basis for functional testing of the CO_2 system is sufficient to ensure system availability and operability. This frequency is sufficient based on station operating experience.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
3. Parameters Monitored or Inspected 4. Detection of Aging Effects 5. Monitoring and Trending 6. Acceptance Criteria	The Fire Protection Program will be enhanced to explicitly state that the diesel fire pump engine sub-systems (including the fuel supply line) shall be observed while the engine is running. Acceptance criteria will be revised to verify that the diesel engine does not exhibit signs of degradation while running, such as excessive fuel oil, lube oil, coolant, or exhaust gas leakage.
3. Parameters Monitored or Inspected 4. Detection of Aging Effects 5. Monitoring and Trending 6. Acceptance Criteria	The Fire Protection Program will be enhanced to specify that diesel fire pump engine carbon steel exhaust components are inspected for evidence of corrosion or cracking at least once every five years.
3. Parameters Monitored or Inspected 4. Detection of Aging Effects 5. Monitoring and Trending	The Fire Protection Program will be enhanced to require visual inspections of fire damper framing to check for signs of degradation.
3. Parameters Monitored or Inspected 4. Detection of Aging Effects 5. Monitoring and Trending	The Fire Protection Program will be enhanced to require visual inspections of the Halon and CO_2 fire suppression systems at least once every six months to check for signs of degradation in a manner suitable for trending.
3. Parameters Monitored or Inspected 6. Acceptance Criteria	The Fire Protection Program will be enhanced to include inspection of cardox hose reels for corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion.
4. Detection of Aging Effects	The Fire Protection Program will be enhanced to require visual inspections of concrete flood curbs, manways, hatches, and hatch covers on an 18-month basis to check for signs of degradation.

Operating Experience

In 2002, 2004 and 2005, inspections of fire barriers and fire walls found certain fire seals unsatisfactory. These included degraded grout and foam seals that had voids and a cracked boot seal. Other similar discrepancies were found during plant tours and walkdowns during normal plant operations or QA audits and were corrected with the site Corrective Action Program.

In 2003 and 2006 fire door inspections found gaps in doors that exceeded specifications. Gaps were evaluated after further inspection and found to meet requirements, required procedural clarification of specifications, or were restored to specifications. Corrective actions were accomplished in accordance with the site Corrective Action Program.

In 2002 and 2004 during 30 day inspections of fire doors, discrepancies were noted. In 2002 a fire door was found with excessive gaps. In 2004 a door was found with a tear in the outer skin. Doors were restored to specifications according to the site Corrective Action Program.

Annual fire pump flow testing was completed in 2005 for fire pump D and 2006 for fire pumps D and E. The testing results were satisfactory in both years but prompted enhancements in operating procedures and component settings. In 2005, the operating procedure for D pump was enhanced to clarify the operation of the pump as a result of the testing. In 2006, fire pump D required adjustment of the time delay for restart. The testing of fire pump E in 2006 was satisfactory with no discrepancies noted. Corrective actions were accomplished in accordance with the site Corrective Action Program.

Results of past inspections of the external surfaces of the CO_2 and Halon fire protection systems have indicated no loss of intended function due to general corrosion.

QA audits of the Fire Protection Program were conducted in 2004, 2005, 2006 and 2007. Although these audits covered the overall program, specific walkdowns and inspections of fire barriers conducted in numerous areas of the plant revealed no significant issues.

In 2006 the NRC completed three quarterly integrated inspection reports concerning selected areas of plant operation, including fire protection. Walkdowns of numerous areas of the plant to assess the material condition of passive fire protection features were completed with no significant findings or issues noted. These walkdowns confirm that the program is effective for managing aging effects for passive components.

An NRC Notice of Violation in the Fire Protection area was issued in June 2008. The violation involved inadequacy of an emergency operating procedure a situation unrelated to the effects of aging.

Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Fire Protection Program has been effective at managing aging effects. The Fire Protection Program assures 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.1.17 FIRE WATER SYSTEM

Program Description

The Fire Water System Program is an existing program that applies to water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, and aboveground and underground piping and components that are tested in accordance with applicable National Fire Protection Association (NFPA) codes and standards. Such testing assures functionality of systems. To determine if significant corrosion has occurred in water-based fire protection systems, periodic flushing, system performance testing and inspections are conducted. Also, many of these systems are normally maintained at required operating pressure and monitored such that leakage resulting in loss of system pressure is immediately detected and corrective actions initiated.

In addition, wall thickness evaluations of fire protection piping are periodically performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion.

A sample of sprinkler heads will be tested or replaced using the guidance of NFPA-25 (2002 edition), Section 5.3.1.1.1. NFPA-25 states, "Where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing." This sampling will be repeated every 10 years after initial field service testing per the guidance of NFPA-25.

NUREG-1801 Consistency

The Fire Water System Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M27, Fire Water System, with exceptions.

Exceptions to NUREG-1801

The Fire Water System Program is consistent with the program described in NUREG-1801, Section XI.M27, Fire Water System, with the following exceptions.

Elements Affected	Exceptions
4. Detection of Aging Effects	NUREG-1801 recommends annual fire hydrant hose hydrostatic tests. However, the hoses are not subject to aging management since they are periodically inspected, hydrotested, and replaced.[1]

Elements Affected	Exceptions
4. Detection of Aging Effects	NUREG-1801 recommends annual gasket inspections. However, gaskets are not subject to aging management review since they are periodically inspected and replaced.[2]

Exception Notes

1. Fire hoses are replaced based on periodic performance or condition monitoring and are excluded from aging management review per Table 2.1-3 of NUREG-1800 Rev. 1.
2. Gaskets are replaced based on performance or condition monitoring and are excluded from aging management review per Table 2.1-3 of NUREG-1800 Rev. 1.

<u>Enhancements</u>

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
3. Parameters Monitored or Inspected 6. Acceptance Criteria	The Fire Water System Program will be enhanced to include inspection of hose reels for corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion.
3. Parameters Monitored or Inspected 6. Acceptance Criteria	The Fire Water System Program will be enhanced to include visual inspection of spray and sprinkler system internals for evidence of corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion.
3. Parameters Monitored or Inspected 4. Detection of Aging Effects	Wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.

Elements Affected	Enhancements
4. Detection of Aging Effects	A sample of sprinkler heads required for 10 CFR 50.48 will be tested or replaced using guidance of NFPA-25 (2002 edition), Section 5.3.1.1.1, before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation.

Operating Experience

System flow verification tests were performed in 2003 and 2004 with no discrepancies noted.

Yard hydrant flow checks were performed in 2003, 2004 and 2006 with no discrepancies noted. The hydrant flow checks done in 2005 noted a valve that was stuck closed. This valve was repaired and returned to service. In 2002, evidence of MIC was found in the Fire Water System during inspections. Corrective actions were accomplished in accordance with the site Corrective Action Program. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

QA audits in 2004, 2005, 2006 and 2007 indicated that the program was effectively maintained and implemented. Reviews against established program standards provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Fire Water System Program has been effective at managing aging effects. The Fire Water System Program assures 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.1.18 FLOW-ACCELERATED CORROSION

Program Description

The Flow-Accelerated Corrosion (FAC) Program is an existing program that applies to safety-related and nonsafety-related carbon steel components and gray cast iron in systems containing high-energy fluids carrying two-phase or single-phase high-energy fluid greater than or equal to two percent of plant operating time per the criteria given in EPRI NSAC-202L.

The program, based on EPRI recommendations in NSAC-202L for an effective flow-accelerated corrosion program, predicts, detects, and monitors FAC in plant piping and other pressure retaining components. This program includes (a) an evaluation to determine critical locations, (b) initial operational inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm predictions or to repair or replace components as necessary. The aging effect of loss of material managed by the Flow Accelerated Corrosion Program is equivalent to the aging effect of wall thinning as defined in NUREG-1801 Volume 2 Table IX.E.

NUREG-1801 Consistency

The FAC Program, with enhancement, is consistent with the program described in NUREG-1801, Section XI.M17, Flow-Accelerated Corrosion, with an exception.

Exceptions to NUREG-1801

The FAC Program is consistent with the program described in NUREG-1801, Section XI.M17, Flow-Accelerated Corrosion, with the following exception.

Elements Affected	Exception
4. Detection of Aging Effects	NUREG-1801 recommends using both ultrasonic (UT) and radiographic testing to detect wall thinning. CNS uses UT only.[1]

Exception Note

1. This is sufficient because, as stated in NSAC-202L Revision 2, the UT method provides more complete data for measuring the remaining wall thickness.

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Elements Affected	Enhancement
1. Scope of Program	The System Susceptibility Analysis for the Flow-Accelerated Corrosion Program will be updated to reflect the lessons learned and new technology that became available after the publication of NSAC-202L Revision 1.

Operating Experience

From 2002 through 2006, FAC ultrasonic examinations of carbon steel components in systems containing steam and treated water revealed wall thinning due to corrosion, erosion, and FAC. The evaluation of each indication determined an additional period until minimum wall thickness would be exceeded or justified continued operation until the next available time for repair. Corrective actions were accomplished in accordance with the site Corrective Action Program. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for carbon steel components.

Enhancements to the FAC program were incorporated via self-assessments done in 2002 and 2003. A self-assessment done in 2006 concluded that the FAC program meets the recommendations of NSAC-202L, with areas for improvement tracked in the Corrective Action Program. These assessments confirmed that the program met or exceeded industry standards and was well implemented according to procedures.

Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Flow-Accelerated Corrosion Program has been effective at managing aging effects. The Flow-Accelerated Corrosion Program assures 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.1.19 INSERVICE INSPECTION – ISI

Program Description

The Inservice Inspection – ISI Program is an existing program that encompasses ASME Section XI Subsection IWB, IWC, and IWD requirements.

This program manages loss of material, cracking, and reduction of fracture toughness to assure that the pressure boundary functions of the reactor pressure vessel and reactor coolant system pressure boundary are maintained through the period of extended operation.

Regulation 10 CFR 50.55a, imposes inservice inspection (ISI) requirements of ASME Code, Section XI, for Class 1, 2, and 3 pressure-retaining components, their integral attachments, and supports in light-water cooled power plants. Inspection, repair, and replacement of these components are covered in Subsections IWB, IWC, and IWD respectively. The program includes periodic visual, surface, and volumetric examination and leakage tests of Class 1, 2, and 3 pressure-retaining components, their integral attachments and supports.

The ISI Program is based on ASME Inspection Program B, which has 10-year inspection intervals. Every 10 years the program is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50.55a. On March 1, 2006, CNS entered the fourth ISI interval. The ASME code edition and addenda used for the fourth interval is the 2001 Edition, 2003 Addenda.

NUREG-1801 Consistency

The Inservice Inspection – ISI Program is consistent with the program described in NUREG-1801, Section XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, with exceptions.

Exceptions to NUREG-1801

The Inservice Inspection – ISI Program consistent with the program described in NUREG-1801, Section XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, with the following exceptions.

Elements Affected	Exceptions
3. Parameters Monitored or Inspected 4. Detection of Aging Effects	NUREG-1801 recommends the use of ASME Section XI Table IWB-2500-1 to determine the method of examination of category B-F and B-J welds. CNS uses examination category R-A in accordance with risk informed methodology approved by NRC for examination of Table IWB-2500-1 category B-F and B-J welds.[1]

Elements Affected	Exceptions
4. Detection of Aging Effects	NUREG-1801 recommends the use of ASME Section XI, Subsection IWA-2000 to set distance and lighting requirements for VT-2 inspections for leak detection performed during system pressure tests. CNS uses an alternate approach.[2]
4. Detection of Aging Effects	NUREG-1801 recommends the use of the reactor coolant system boundary, with all valves in the normal position required for normal reactor operation startup, as the pressure-retaining boundary during the system leakage test per ASME Section XI IWB-5222. CNS reactor coolant system leakage test boundaries are refined as follows. • The outboard MSIVs, the main steam line drain valves, the HPCI and RCIC steam supply valves, and three of the feedwater check valves are closed during the system leakage test, but are included in the VT-2 visual examination. • In addition, reactor coolant pressure boundary vent, drain, and branch (VTDB) connections 1-inch NPS and smaller are visually examined for leakage with the inboard isolation valve in the normally closed position during the system leakage test conducted at or near the end of each inspection interval.[3]
4. Detection of Aging Effects	NUREG-1801 recommends using the system pressure test requirements of IWB-5210(b) and IWB-5221(a). In lieu of this, CNS performs a VT-2 visual examination on the reactor pressure vessel (RPV) head flange leak detection line either when the reactor cavity is flooded or when it is pressurized to 100 psig.[4]

Exception Notes

1. Significant industry attention has been devoted to the application of risk-informed selection criteria in order to determine the scope of inservice inspection programs at nuclear power plants. CNS applied the methodology documented in the NRC-approved EPRI Topical Report TR-112657 in the development of the CNS Risk-Informed Inservice Inspection (RI-ISI) Program. The use of this methodology for the selection and subsequent examination of Class 1 piping welds provides an acceptable level of quality and safety. This alternative to the ASME code has been approved in accordance with the provisions of 10 CFR 50.55a(a)(3) for the 4th interval (TAC No. MD0283 dated 10/23/2006). To continue the alternative in subsequent intervals during the period of extended operation, approval must be obtained in accordance with 10 CFR 50.55a.

2. To prevent the extra scaffolding and radiation exposure needed to meet the distance and lighting requirements of IWA-2210, CNS conducts VT-2 examinations to detect evidence of leakage from pressure retaining components without a distance limitation and prescribes examinations in accordance with IWA-5000. IWA-5000 allows examination of floor areas or equipment surfaces underneath an inaccessible component for evidence of leakage. The NRC Staff has determined that the minimum illumination level and maximum direct examination distance need not be specified in order to perform effective VT-2 examinations. A VT-2 examination is conducted to detect evidence of leakage, and such leakage can be detected effectively beyond the code-specified minimum distance. Leakage can also be detected well under the code-specified minimum illumination level. Even if the general illumination level in the general building area of interest is below the minimum specified illumination level, supplemental spot lighting, if necessary, can be utilized.
   This alternative to the ASME code has been approved in accordance with the provisions of 10 CFR 50.55a(a)(3) for the 4th interval (TAC No. MD0323 dated 8/23/2006). To continue the alternative in subsequent intervals during the period of extended operation, approval must be obtained in accordance with 10 CFR 50.55a.

3. Performing the pressure test with the normal reactor coolant system boundary would result in a hardship without a compensating increase in quality and safety due to excessive radiation exposure and personnel safety concerns (temperature levels in the drywell). These alternate provisions provide reasonable assurance of the continued operational readiness of mechanical connections, extending to the Class 1 boundary. This alternative to the ASME code has been approved in accordance with the provisions of 10 CFR 50.55a(a)(3) for the 4th interval (TAC No. MD0284 dated 10/2/2006 and TAC No. MD0515 dated 10/2/2006). To continue the alternative in subsequent intervals during the period of extended operation, approval must be obtained in accordance with 10 CFR 50.55a.

4. Performing such a test per the system pressure test requirements of IWB-5210(b) and IWB-5221(a) is impractical because of the possibility of damage to the RPV head flange O-ring seals. These alternate provisions provide reasonable assurance of the structural integrity of the subject line. This alternative to the ASME code has been approved in accordance with the provisions of 10 CFR 50.55a(a)(3) for the 4th interval (TAC No. MD0285 dated 10/2/2006). To continue the alternative in subsequent intervals during the period of extended operation, approval must be obtained in accordance with 10 CFR 50.55a.

Enhancements

None

Operating Experience

Results of ISI examinations during RE20 in 2001 revealed acceptable indications in the core spray piping and the core spray piping collar supports. Results of ISI examinations during RE22 in 2005 revealed acceptable indications and flaws that required repair and reexamination. Successive examinations are required in the next period. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

A self-assessment in 2005 confirmed that the program met regulatory requirements and industry standards. The results of this assessment were used to develop the program changes in preparation for the next 10 year interval.

The ISI Program detects aging effects via visual, surface and ultrasonic inspection. Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components. Ultrasonic inspection methods are subject to the performance demonstration requirements of ASME Section XI, Appendix VIII. In addition, the ISI programs are based on industry wide experience.

Conclusion

The Inservice Inspection – ISI Program has been effective at managing aging effects. The Inservice Inspection – ISI Program assures 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.1.20 INSERVICE INSPECTION – IWF

Program Description

The Inservice Inspection – IWF Program is an existing program that manages loss of material for ASME Class 1, 2, 3 and MC piping and component supports, bolting, and base plates. The program uses the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition, 2003 Addenda.

The program includes visual inspections of surfaces to manage loss of material. Evidence of corrosion, deformation, misalignment, improper clearances, improper spring settings, damage to close tolerance machined or sliding surfaces, and missing, detached, or loosened support items that may compromise support function or load capacity are detected through visual inspection.

NUREG-1801 Consistency

The Inservice Inspection – IWF Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S3, ASME Section XI, Subsection IWF with an exception.

Exceptions to NUREG-1801

The Inservice Inspection - IWF Program is consistent with the program described in NUREG-1801, Section XI.S3, ASME Section XI, Subsection IWF with the following exception.

Elements Affected	Exception
4. Detection of Aging Effects	NUREG-1801 recommends a VT-3 visual examination as specified in Table IWF-2500-1. Lighting and distance requirements for VT-3 visual examinations are specified in Table IWA-2210-1. The maximum direct examination distance requirement is not always followed for the VT-3 examination.[1]

Exception Note

1. A VT-3 examination is performed to determine the general mechanical and structural condition of components and their supports, such as physical displacement, general deformation, corrosion, and missing or loose parts. Experience has shown that such conditions and degradation can be detected effectively at distances greater than the Code-required maximum distance criteria. This alternative to the ASME code has been approved in accordance with the provisions of 10 CFR 50.55a(a)(3) for the 4th interval (TAC No. MD0323 dated 8/23/2006). To continue the alternative in subsequent intervals during the period of extended operation, approval must be obtained in accordance with 10 CFR 50.55a.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
1. Scope of Program 4. Detection of Aging Effects	The ISI-IWF Program will be enhanced to include Class MC piping and component supports.
6. Acceptance Criteria	The ISI-IWF Program will be enhanced to clarify that the successive inspection requirements of IWF-2420 and the additional examination requirements of IWF-2430 are applied.

Operating Experience

Results of ISI examinations during RE19 in 2000 revealed indications that required repair and reexamination. Successive reexaminations were required in the next inspection period for some conditions. Results of ISI examinations during RE20 in 2001 revealed a missing jam nut, stiffener plates not shown on support drawings on a sway strut, and a missing scale was found on a variable spring hanger. In addition, there were three recordable indications shown for other structural members. Each of these recordable indications was evaluated as acceptable. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

In 2006 visual inspections found corroded bolting in the Z sump. Corrective actions were accomplished with engineering review in accordance with the site Corrective Action Program.

The Inservice Inspection – IWF Program detects aging effects using visual 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.

Conclusion

The Inservice Inspection – IWF Program has been effective at managing aging effects. The Inservice Inspection – IWF Program assures 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.1.21 MASONRY WALL

Program Description

The Masonry Wall Program is an existing program that manages aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation.

The program includes visual inspection of all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included components are 10 CFR 50.48-required masonry walls, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components. Structural steel components of masonry walls are managed by the Structures Monitoring Program [B.1.36].

Masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

NUREG-1801 Consistency

The Masonry Wall Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S5, Masonry Wall Program.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
1. Scope of Program	The Masonry Wall Program will be enhanced to clarify that the control house–161 kv switchyard is included in the program.
7. Corrective Actions	The Masonry Wall Program will be enhanced to clarify that structures with conditions classified as "acceptable with deficiencies" or "unacceptable" shall be entered into the Corrective Action Program.

Operating Experience

In 1996, 2002, and 2007, CNS conducted inspections of masonry walls. Masonry Wall Inspection Checklists in 1996 and 2002 documented cracks in the Machine Shop masonry walls. These cracks were evaluated and determined to be acceptable. Identification of deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing aging effects of components.

Conclusion

The Masonry Wall Program has been effective at managing aging effects. The Masonry Wall Program assures 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.1.22 METAL-ENCLOSED BUS INSPECTION

Program Description

The Metal Enclosed Bus Inspection Program is a new program that inspects the following non-segregated phase bus.

- non-segregated bus between the emergency station service transformer and 4.16 kV switchgear buses (1F and 1G)
- non-segregated bus between the start-up station service transformer X winding and 4.16 kV switchgear buses (1A and 1B)

Inspections of the metal enclosed bus (MEB) will include the bus and bus connections, the bus enclosure assemblies, and the bus insulation and insulators. A sample of the accessible bolted connections will be inspected for loose connections. The bus enclosure assemblies will be inspected for loss of material and elastomer degradation. This program will be used instead of the Structures Monitoring Program for external surfaces of the bus enclosure assemblies. The bus insulation or insulators will be inspected for degradation leading to reduced insulation resistance (IR). These inspections will include visual inspections, as well as quantitative measurements, such as thermography or connection resistance measurements, as required.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E4, Metal Enclosed Bus.

NUREG-1801 Consistency

The Metal-Enclosed Bus Inspection Program will be consistent with the program described in NUREG-1801, Section XI.E4, Metal-Enclosed Bus, with an exception.

Exceptions to NUREG-1801

The Metal-Enclosed Bus (MEB) Inspection Program will be consistent with the program described in NUREG-1801, Section XI.E4, Metal-Enclosed Bus Aging Management Program, with the following exception.

Elements Affected	Exception
3. Parameters Monitored or Inspected 4. Detection of Aging Effects	NUREG-1801 specifies the Metal Enclosed Bus Inspection Program for inspection of the internal portion of the MEBs, and specifies the Structures Monitoring Program for inspection of the external portion of the MEBs. The CNS Metal Enclosed Bus Inspection Program specifies visual inspection of the external surfaces of the MEB enclosure assemblies in addition to internal portions.[1]

Exception Note

1. Inspection of the external portion of MEB enclosure assemblies under the Metal Enclosed Bus Inspection Program instead of the Structures Monitoring program assures that effects of aging will be identified prior to loss of intended function. Visual inspections have been proven effective in detecting indications of loss of material.

Enhancements

None

Operating Experience

The Metal-Enclosed Bus Inspection Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the Metal-Enclosed Bus Inspection Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The Metal-Enclosed Bus Inspection Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Metal-Enclosed Bus Inspection Program provides assurance that 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.1.23 NEUTRON ABSORBER MONITORING

Program Description

There is no corresponding NUREG-1801 program.

The Neutron Absorber Monitoring Program is an existing program that manages loss of material of Boral neutron absorption panels in the spent fuel racks. The program relies on representative coupon samples mounted in surveillance assemblies located in the spent fuel pool to monitor performance of the absorber material without disrupting the integrity of the storage system.

Surveillance assemblies are removed from the spent fuel pool on a prescribed schedule and physical and chemical properties are measured. From this data, the stability and integrity of Boral in the storage cells are assessed.

Evaluation

1. Scope of Program

The Neutron Absorber Monitoring Program includes all Boral in the CNS spent fuel pool.

2. Preventive Actions

This is an inspection program and no actions are taken as part of this program to prevent or mitigate aging degradation.

3. Parameters Monitored or Inspected

The program monitors changes that can lead to loss of material of Boral material.

4. Detection of Aging Effects

The program monitors representative coupon samples located in the spent fuel pool to determine the condition of the absorber material without disrupting the integrity of the storage system. Visual inspections are used to determine and assess the extent of loss of material in the Boral before there is a loss of intended function. Results from CNS Boral coupons, inspected in 1982 and 1992, were evaluated and found that the reduction of neutron-absorbing capacity (change in material properties) is insignificant. Therefore, CNS no longer evaluates Boral coupons for change of material properties.

This program manages loss of material of the Boral neutron absorber.

5. Monitoring and Trending

Visual inspections determine the extent of loss of material. These inspections are reported in a manner which allows trending of results.

6. Acceptance Criteria

Control coupons are inspected concurrently with the coupons removed from the surveillance assembly. Comparison to these control coupons provides the acceptance criteria against which the need for corrective action is evaluated.

7. Corrective Actions

When adverse trends are identified, engineering will determine the appropriate course of action and document it through the CNS Corrective Action Program. Timely corrective action is assured through this 10 CFR 50 Appendix B program.

8. Confirmation Process

This element is discussed in Section B.0.3.

9. Administrative Controls

This element is discussed in Section B.0.3.

10. Operating Experience

Results of an inspection of coupon samples in 2002 showed no significant degradation of Boral material. Overall the results indicate the boral coupon samples are not degrading within the spent fuel storage pool (SFSP).

Since the coupons have been consistent in weight, dimension and characteristics for about 20 years the inspection interval was evaluated and extended from 4 years to 8 years in 2006. The next scheduled inspection of the Boral coupons is in 2010.

Enhancements

None

Conclusion

The Neutron Absorber Monitoring Program has been effective at managing aging effects. The Neutron Absorber Monitoring Program assures 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.1.24 NON-EQ BOLTED CABLE CONNECTIONS

Program Description

There is no corresponding NUREG-1801 program.

The Non-EQ Bolted Cable Connections Program is a new one-time inspection program. Cable connections are used to connect cable conductors to other cables or electrical devices. Connections associated with cables within the scope of license renewal are considered for this program. The most common types of connections used in nuclear power plants are splices (butt or bolted), crimp-type ring lugs, connectors, and terminal blocks. Most connections involve insulating material and metallic parts. This aging management program (AMP) focuses on the metallic parts of the electrical cable connections. This program provides a one-time inspection, on a sampling basis, to confirm the absence of age-related degradation of bolted cable connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. This program does not apply to the high voltage (> 35 kV) switchyard connections.

The Metal Enclosed Bus Inspection Program manages aging effects from thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation on the metallic parts of MEB connections. Therefore, MEB connections are not included in this program.

Electrical cable connections exposed to appreciable ohmic or ambient heating during operation may experience loosening caused by repeated cycling of connected loads or cycling of the ambient temperature environment. Bolted connectors, splices, and terminal blocks may loosen if subjected to significant thermally induced cyclic stress.

The design of these connections will account for the stresses associated with ohmic heating, thermal cycling, and dissimilar metal connections. Therefore, these stressors/mechanisms should not be a significant issue. However, confirmation of the lack of these effects is warranted.

This program provides for one-time inspections on a sample of connections that will be completed prior to the period of extended operation. The factors considered for sample selection will be application (medium and low voltage, defined as < 35 kV), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc.). The technical basis for the sample selections will be documented. If an unacceptable condition or situation is identified in the selected sample, the Corrective Action Program will be used to evaluate the condition and determine appropriate corrective action.

This program will ensure that electrical cable connections will perform their intended function through the period of extended operation and will be implemented prior to the period of extended operation.

Evaluation

1. Scope of Program

Cable connections external to terminations at active or passive devices associated with non-EQ cables in scope of license renewal are part of this program. This program does not include the high voltage (> 35 kV) switchyard connections. In-scope connections are evaluated for applicability of this program. The criteria for including connections in the program are that the connection is a bolted connection that is not covered under the EQ program or an existing preventive maintenance program.

2. Preventive Actions

This one-time inspection program is a condition monitoring program; therefore, no actions will be taken as part of this program to prevent or mitigate aging degradation.

3. Parameters Monitored or Inspected

This program will focus on the metallic parts of the cable connections. The one-time inspection verifies that loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation is not an aging effect that requires a periodic aging management program.

4. Detection of Aging Effects

A representative sample of electrical connections within the scope of license renewal, and subject to aging management review will be inspected or tested at least once prior to the period of extended operation to verify there are no aging effects requiring management during the period of extended operation. The factors considered for sample selection will be application (medium and low voltage), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc.). The technical basis for the sample selected will be documented. Inspection methods may include thermography, contact resistance testing, or other appropriate methods based on plant configuration and industry guidance. The one-time inspection provides additional confirmation to support industry and CNS operating experience that shows that electrical connections have not experienced a high degree of failures and that existing installation and maintenance practices are effective.

5. Monitoring and Trending

Trending actions will not be included as part of this program because this is a one-time inspection.

6. Acceptance Criteria

The acceptance criteria for each inspection or test will be defined by the specific type of inspection or test performed for the specific type of cable connections. Acceptance criteria will ensure that the intended functions of the cable connections can be maintained consistent with the current licensing basis.

7. Corrective Actions

If the inspection or test acceptance criteria are not met, the requirements of 10 CFR Part 50, Appendix B, will be used to address corrective actions. The Corrective Action Program will be used to perform an evaluation that will consider extent of condition, the indications of aging effects, and possible changes to the one-time inspection program such as frequency and sample size.

8. Confirmation Process

This element is discussed in Section B.0.3.

9. Administrative Controls

This element is discussed in Section B.0.3.

10. Operating Experience

Industry operating experience has shown that loosening of connections and corrosion of connections could be a problem without proper installation and maintenance activities. Industry and CNS operating experience supports performing this one-time inspection program in lieu of a periodic testing program. This one-time inspection program will verify that the installation and maintenance activities are effective.

The Non-EQ Bolted Cable Connection Program is a new program. Industry and plant-specific operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

Conclusion

The Non-EQ Bolted Cable Connections Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Bolted Cable Connections Program provides assurance that effects of aging will be managed such that applicable cable connections will continue to perform their intended function consistent with the current licensing basis through the period of extended operation.

B.1.25 NON-EQ INACCESSIBLE MEDIUM-VOLTAGE CABLE

Program Description

The Non-EQ Inaccessible Medium-Voltage Cable Program is a new program that inspects the following underground medium-voltage cables.

- inaccessible medium-voltage cables between the station service water pumps (SWP-1A, 1B, 1C, and 1D) and the 4.16 kV safety switchgear
- inaccessible medium-voltage cables between 12.5 kV overhead loop and the fire pump motor (FP-MOT-E)
- inaccessible medium-voltage cables between the standby diesel (DG1 and DG2) to the 4.16 kV safety busses (1F and 1G)
- inaccessible medium-voltage cables between the 4.16 kV non-safety buses (1A and 1B) and the 161 kV control house power transformers (located in the 345 kV switchyard)

The Non-EQ Inaccessible Medium-Voltage Cable Program entails periodic inspections for water collection in cable manholes and periodic testing of cables. In-scope medium-voltage cables (cables with operating voltage from 2 kV to 35 kV) exposed to significant moisture and voltage will be tested at least once every ten years to provide an indication of the condition of the conductor insulation. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that lasts less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time.

The program includes inspections for water accumulation in manholes at least once every two years.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

NUREG-1801 Consistency

The program will be consistent with NUREG-1801, Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Non-EQ Inaccessible Medium-Voltage Cable Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the Non-EQ Inaccessible Medium-Voltage Cable Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

A search of CNS operating experience with manholes containing in-scope medium-voltage cables identified one event. The event, which occurred in 2003, was for a high-level alarm in the control room due to failure of a manhole sump pump to auto-start. Due to the automatic sump pumps and associated high-level alarms in the manholes, a frequency of at least once every two years for manhole inspections is adequate for the Non-EQ Inaccessible Medium-Voltage Cable Program.

Conclusion

The Non-EQ Inaccessible Medium-Voltage Cable Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Inaccessible Medium-Voltage Cable Program provides assurance that 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.1.26 NON-EQ INSTRUMENTATION CIRCUITS TEST REVIEW

Program Description

The Non-EQ Instrumentation Circuits Test Review Program is a new program that inspects the applicable cables in the following systems or sub-systems.

- neutron monitoring system intermediate range monitors
- neutron monitoring system local power range monitors
- neutron monitoring system average power range monitors
- reactor building ventilation exhaust radiation monitors
- main steam line radiation monitors

The Non-EQ Instrumentation Circuits Test Review Program assures the intended functions of sensitive, high-voltage, low-signal cables exposed to adverse localized equipment environments caused by heat, radiation and moisture (i.e., neutron flux monitoring instrumentation, reactor building ventilation exhaust radiation monitoring, and main steam line radiation monitoring) can 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 before 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 system (such as insulation resistance tests or time domain reflectometry) will occur at least once every ten years, with the first test occurring before the period of extended operation. This program will consider the technical information and guidance provided by the industry.

The program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E2, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.

NUREG-1801 Consistency

The program will be consistent with NUREG-1801, Section XI.E2, 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 Non-EQ Instrumentation Circuits Test Review Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the Non-EQ Instrumentation Circuits Test Review Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The Non-EQ Instrumentation Circuits Test Review Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Instrumentation Circuits Test Review Program provides assurance that 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.1.27 NON-EQ INSULATED CABLES AND CONNECTIONS

Program Description

The Non-EQ Insulated Cables and Connections Program is a new program that assures the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is significantly more severe than the specified service condition for the insulated cable or connection.

A representative sample of accessible insulated cables and connections within the scope of license renewal will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. The program sample consists of all accessible cables and connections in localized adverse environments.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

NUREG-1801 Consistency

The Non-EQ Insulated Cables and Connections Program will be consistent with the program described in NUREG-1801, Section XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Non-EQ Insulated Cables and Connections Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the Non-EQ Insulated Cables and Connections Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The Non-EQ Insulated Cables and Connections Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Insulated Cables and Connections Program provides assurance that 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.1.28 OIL ANALYSIS

Program Description

The Oil Analysis Program is an existing program that maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to loss of material, cracking, or fouling. Activities include sampling and analysis of lubricating oil for detrimental contaminants, water, and particulates.

Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results.

The One-Time Inspection Program [B.1.29] utilizes inspections or non-destructive evaluations of representative samples to verify that the Oil Analysis Program has been effective at managing aging effects.

NUREG-1801 Consistency

The Oil Analysis Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M39, Lubricating Oil Analysis.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
3. Parameters Monitored or Inspected	The Oil Analysis Program will be enhanced to include viscosity, neutralization number, and flash point determination of oil samples from components that do not have regular oil changes, along with analytical ferrography and elemental analysis for the identification of wear particles.
3. Parameters Monitored or Inspected	The Oil Analysis Program will be enhanced to include screening for particulate and water content for oil replaced periodically.

Elements Affected	Enhancements
6. Acceptance Criteria	The Oil Analysis Program will be enhanced to formalize preliminary oil screening for water and particulates and laboratory analyses, including defined acceptance criteria for all components included in the scope of the program. The program will specify corrective actions in the event acceptance criteria are not met.

Operating Experience

The CNS quarterly oil reports provide a periodic summary of the results of oil analysis. The results for the period 2006 and 2007 indicate that lube oil for the RCIC, HPCI and DG systems were within the specifications required for this period. The RCIC system particulate count indicated an adverse trend but did not exceed minimum limits for this period. The HPCI system water content indicated an adverse trend but did not exceed minimum limits for this period. The DG system particulate and lead content indicated an adverse trend but did not exceed minimum limits for this period. In 2004 and 2005 oil samples from the service air compressor indicated excessive water content. Corrective actions included replacement and cleanup of components in addition to an oil changeout of the reservoir. Retest indicated that the water content was only a trace and within acceptable levels. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for carbon steel components.

Water content continued to be monitored in the 2nd quarter of 2007 with the HPCI system trending plan. This trending plan monitors water levels in the oil, considering concerns from a system drain and refill in 2005. The HPCI lube oil sump samples detected a decreasing amount of water from June to September 2006. This trace amount was evaluated and shown to be well below any specified limitations. No corrective maintenance was required at that time. Continuous confirmation of oil quality provides evidence that the program is effective in managing aging effects for lube oil components.

In 2007 service water outboard bearing oil samples appeared to be dark and contained debris. Oil analysis of the service water pump outboard bearing indicated no water content but that iron and copper content had risen. The frequency of analysis was increased from 6 months to monthly for improved trending of iron and copper content. Identification of program deficiencies and subsequent corrective actions provide assurance that the program will remain effective for managing loss of material of components.

In 2006, contaminant levels were high out of specification on the main turbine lube oil system. Further review indicated that water in-leakage was occurring from a gland steam seal valve packing leak to the bearing pedestal oil seals. The packing leaks were corrected returning water levels to acceptable. Use of warning level indicators to direct corrective actions prior to equipment degradation provides evidence that the program is effective in managing aging effects.

An EPRI Predictive Maintenance Program Assessment was done in 2004. The oil analysis program was one of several programs reviewed. As a result of this assessment the procedures for this program were revised and updated to include expectations for trending, initiation of condition reports for anomalies, and periodic report generation. Also as a result of this assessment, sample ports were installed on equipment, a minilab was set up on site to expedite results, program owner responsibilities were better defined, and improved training was provided to ensure backup capabilities for program application. Identification of program deficiencies and subsequent corrective actions provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Oil Analysis Program has been effective at managing aging effects. The Oil Analysis Program assures 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.1.29 ONE-TIME INSPECTION

Program Description

The One-Time Inspection Program is a new program that will include measures to verify effectiveness of an aging management program (AMP) and confirm the insignificance of an aging effect. For structures and components that rely on an AMP, this program will verify effectiveness of the AMP by confirming that unacceptable degradation is not occurring and the intended function of a component will be maintained during the period of extended operation. One-time inspections may be needed to address concerns for potentially long incubation periods for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, or (b) an aging effect is expected to progress very slowly. For these cases, there will be confirmation that either (a) the aging effect is indeed not occurring, or (b) the aging effect is occurring very slowly as not to affect the component or structure intended function. A one-time inspection of the subject component or structure is appropriate for this verification. The inspections will be nondestructive examinations (including visual, ultrasonic, or surface techniques). The inspection will be performed within the ten years prior to the period of extended operation.

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

Diesel fuel monitoring program	One-time inspection activity will verify the effectiveness of the diesel fuel monitoring aging management programs by confirming that unacceptable loss of material is not occurring.
Oil analysis program	One-time inspection activity will verify the effectiveness of the oil analysis aging management programs by confirming that unacceptable cracking, loss of material, and fouling is not occurring.
Water chemistry control programs	One-time inspection activity will verify the effectiveness of the three water chemistry control aging management programs by confirming that unacceptable cracking, loss of material, and fouling is not occurring.
Main steam line flow elements (CASS) Reactor recirculation flow elements (CASS)	One-time inspection activity will confirm that cracking and reduction of fracture toughness are not occurring or are so insignificant that an aging management program is not warranted.

Internal surfaces of stainless steel components in the standby gas treatment system containing raw water (drain water)	One-time inspection activity will confirm that loss of material is not occurring or is so insignificant that an aging management program is not warranted.
Internal surfaces of stainless steel tubing in the circulating water system containing raw water (river water)	One-time inspection activity will confirm that loss of material is not occurring or is so insignificant that an aging management program is not warranted.
Internal surfaces of stainless steel tubing and components in the off gas system containing raw water (drain water)	One-time inspection activity will confirm that loss of material is not occurring or is so insignificant that an aging management program is not warranted.
Internal surfaces of stainless steel components in the radwaste system containing raw water (drain water)	One-time inspection activity will confirm that loss of material is not occurring or is so insignificant that an aging management program is not warranted.
Internal surfaces of stainless steel tubing and components in the service air system exposed to condensation	One-time inspection activity will confirm that loss of material is not occurring or is so insignificant that an aging management program is not warranted.

The elements of the One-Time Inspection Program include (a) determination of the sample size 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 aging effect; (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) evaluation of the need for follow-up examinations to monitor the progression of any aging degradation.

A representative sample will be selected from each unique material and environment combination covered under each of the activities. Each sample size will be based on Chapter 4 of EPRI document 107514, Age Related Degradation Inspection Method and Demonstration, which outlines a method to determine the number of inspections required for 90% confidence that 90% of the population does not experience degradation (90/90). Components with the same material-environment combinations at other facilities may be included in the sample.

The program provides for increasing inspection sample size and locations in the event that aging effects are detected. Unacceptable inspection findings are evaluated in accordance with the corrective action process to determine the need for subsequent (including periodic) inspections and for monitoring and trending the results.

For specific system components where significant aging effects are not expected, one-time inspection activities are used to confirm that loss of material, cracking, and reduction of fracture toughness, as applicable, are not occurring or are so insignificant that an aging management program is not warranted. When evidence of an aging effect is revealed by a one-time inspection, routine evaluation of the inspection results will identify appropriate corrective actions.

NUREG-1801 Consistency

The One-Time Inspection Program will be consistent with the program described in NUREG-1801, Section XI.M32, One-Time Inspection.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The One-Time Inspection Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the One-Time Inspection Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The One-Time Inspection Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The One-Time Inspection Program provides assurance that the Water Chemistry Control, Diesel Fuel Monitoring, and Oil Analysis programs will be effective in managing the effects of aging to ensure component intended functions can be maintained in accordance with the current licensing basis (CLB) through the period of extended operation. In addition, the One-Time Inspection Program will confirm the insignificance of aging effects on specific system components where significant aging effects are not expected.

B.1.30 ONE-TIME INSPECTION – SMALL-BORE PIPING

Program Description

The One-Time Inspection – Small-Bore Piping Program is a new program applicable to small-bore American Society of Mechanical Engineers (ASME) Code Class 1 piping less than 4 inches nominal pipe size (NPS 4"), which includes pipe, fittings, and branch connections. The ASME Code does not require volumetric examination of Class 1 small-bore piping. The CNS One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will manage cracking through the use of volumetric examinations.

The program will include a sample selected based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small-bore piping locations.

When evidence of an aging effect is revealed by a one-time inspection, evaluation of the inspection results will identify appropriate corrective actions.

The NUREG-1801 Program Description for Program XI.M35 describes the program to include piping "less than or equal to NPS 4" with a reference to ASME Section XI, Table IWB-2500-1, Examination Category BJ. However, volumetric examinations are already required for piping equal to NPS 4" according to ASME Code. These examinations are included in B.1.19 Inservice Inspection. Consistent with the Code, GALL Item IV.C2-1 applies the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program (XI.M35) only to Class 1 piping less than NPS 4". Based on this, CNS concludes that it is not the intent of GALL for Program XI.M35 to include NPS 4" pipe. Therefore, the CNS One-Time Inspection – Small-Bore Piping Program includes only small-bore Class 1 piping < NPS 4", which is considered consistent with GALL.

The inspection will be performed within the ten years prior to the period of extended operation.

NUREG-1801 Consistency

The One-Time Inspection – Small-Bore Piping Program will be consistent with the program described in NUREG-1801, Section XI.M35, One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The One-Time Inspection – Small-Bore Piping Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the One-Time Inspection – Small-Bore Piping Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The One-Time Inspection –Small-Bore Piping Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The One-Time Inspection – Small-Bore Piping Program provides assurance that 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.1.31 PERIODIC SURVEILLANCE AND PREVENTIVE MAINTENANCE

Program Description

There is no corresponding NUREG-1801 program.

The Periodic Surveillance and Preventive Maintenance Program is an existing program that includes periodic inspections and tests that manage aging effects not managed by other aging management programs. In addition to specific activities in the plant's preventive maintenance program and surveillance program, the Periodic Surveillance and Preventive Maintenance Program includes enhancements to add new activities. The preventive maintenance and surveillance testing activities are generally implemented through repetitive tasks or routine monitoring of plant operations. The program is credited with managing loss of material from external surfaces for situations in which external and internal material and environment combinations are the same such that internal surface condition is representative of external surface condition.

In cases where a representative sample is inspected by this program, a representative sample will be selected from each unique material and environment combination covered under each of the program activities. Each sample size will be based on Chapter 4 of EPRI document 107514, Age-Related Degradation Inspection Method and Demonstration, which outlines a method to determine the number of inspections required for 90% confidence that 90% of the population does not experience degradation (90/90). Components with the same material-environment combinations at other facilities may be included in the sample.

The program provides for increasing inspection sample size and locations in the event that aging effects are detected. Unacceptable inspection findings are evaluated in accordance with the corrective action process to determine the need for subsequent (including periodic) inspections and for monitoring and trending the results.

Credit for program activities has been taken in the aging management review of the following systems and structures.

Reactor building	Perform visual or other non-destructive examination to manage loss of material for carbon steel components of the reactor building monorails, railroad airlock doors, reactor building crane, rails and girders, and refueling bridge equipment assembly.
Reactor building	Perform visual inspection and manually flex a representative sample of the elastomer seals for railroad airlock doors to manage cracking and change in material properties.
Standby liquid control (SLC) system	Perform visual inspection of the internal surfaces of the SLC system accumulator shells to manage loss of material.

High pressure core injection (HPCI) system	Perform visual or other non-destructive examination of the external surfaces of the copper alloy turbine lube oil heat exchanger tubes to manage wear.
Automatic depressurization system (ADS)	Perform visual or other non-destructive examination of carbon steel ADS components in waterline region of the suppression chamber to manage loss of material of main steam relief tailpipes and T-quenchers
Reactor core isolation cooling (RCIC) system	Perform visual inspection of a representative sample of vacuum pump discharge piping, piping elements, and components to manage loss of material and cracking. Perform visual or other non-destructive examination of the external surfaces of the copper alloy turbine lube oil heat exchanger tubes to manage wear.
Standby gas treatment (SGT) system	Perform visual inspection of a representative sample of SGT system carbon steel components exposed to raw water (drain water) to manage loss of material. Perform visual inspection of a representative sample of SGT system copper alloy components exposed to raw water (drain water) to manage loss of material. Perform internal and external visual inspection and manually flex the fan inlet flexible connections to verify the absence of cracks and significant change in material properties.
Plant drains system	Perform internal visual inspection of a representative sample of carbon steel, stainless steel, copper alloy, and gray cast iron plant drain components exposed to raw water (drain water) to manage loss of material. Perform visual inspection of the inside and outside surfaces of a representative sample of gray cast iron and aluminum pump casings exposed to raw water (drain water) to manage loss of material. Perform visual inspection of the outside surface of gasoline-powered gray cast iron pump casings exposed to air – indoor to manage loss of material.
Diesel generator (DG) system	Perform internal visual inspection of a representative sample of DG exhaust gas components to manage loss of material. Perform intercooler operability testing to manage fouling for stainless steel tubes and aluminum fins. Perform visual inspection of a representative sample of DG service air component internal surfaces to manage loss of material.

Heating, ventilation, and air conditioning (HVAC) systems	Visually inspect both internally and externally and flex to the extent possible a representative sample of flexible duct connections composed of elastomer. Visually inspect both internally and externally the portable blower fan housings that are in storage that may be used for ventilation for loss of material. Visually inspect the HVAC flexible trunks that are in storage that may be used for ventilation for cracking and change in material properties. Perform visual or other non-destructive examination to inspect a representative sample of fan coil unit tubes, fins and drip pan to manage loss of material and fouling.
Primary containment (PC) system	Visually inspect the internal surface of a representative sample of carbon steel equipment and floor drain components exposed to raw water (drain water) to manage loss of material.
Nonsafety-related systems affecting safety-related systems	Visually inspect the internal surfaces of a representative sample of carbon steel, copper alloy, and gray cast iron piping, piping elements, and components in the circulating water system exposed to raw water (river water) to manage loss of material. Visually inspect the internal surfaces of a representative sample of carbon steel, copper alloy and gray cast iron piping, piping elements, and components in the nonradioactive floor drain system exposed to raw water (drain water) to manage loss of material. Visually inspect the internal surfaces of a representative sample of carbon steel piping, piping elements, and components in the heating and ventilation (HV) system exposed to raw water (drain water) to manage loss of material. Visually inspect the internal surfaces of a representative sample of carbon steel piping, piping elements, and components in the off gas (OG) system exposed to raw water (drain water) to manage loss of material. Visually inspect the internal surfaces of a representative sample of copper alloy piping, piping elements, and components in the potable water (PW) system exposed to treated water (potable water) to manage loss of material. Visually inspect the internal surfaces of a representative sample of carbon steel and copper alloy piping, piping elements, and components in the radwaste (RW) system exposed to raw water (liquid radwaste) to manage loss of material.

(continued)	Visually inspect the internal surfaces of a representative sample of piping, piping elements, and components in the diesel generator starting air (DGSA) and service air (SA) systems exposed to condensation to manage loss of material.
Instrument air system	Visually inspect the service air primary containment penetration X-21 carbon steel component internal surfaces to manage loss of material.
Nitrogen system	Visually inspect inside surface of carbon steel tank exposed to raw water. Visually inspect the external surface of copper alloy vaporizer coil exposed to raw water inside the nitrogen vaporizer tank to manage loss of material and fouling.

Evaluation

1. Scope of Program

The Periodic Surveillance and Preventive Maintenance Program, with regard to license renewal, includes those tasks credited with managing aging effects identified in aging management reviews.

2. Preventive Actions

Inspection and testing activities used to identify component aging effects do not prevent aging effects. However, activities are intended to prevent failures of components that might be caused by aging effects.

3. Parameters Monitored/Inspected

This program provides instructions for monitoring structures, systems, and components to detect degradation. Inspection and testing activities monitor various parameters including system flow, system pressure, surface condition, loss of material, presence of corrosion products, and signs of cracking.

4. Detection of Aging Effects

Preventive maintenance activities and periodic surveillances provide for periodic component inspections and testing to detect aging effects. Inspection and test intervals are established such that they provide timely detection of degradation. Inspection and test intervals are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations. Each inspection or test occurs at least once every five years.

The extent and schedule of inspections and testing assure detection of component degradation prior to loss of intended functions. Established techniques such as visual inspections are used.

5. Monitoring and Trending

Preventive maintenance and surveillance testing activities provide for monitoring and trending of aging degradation. Inspection and testing intervals are established such that they provide for timely detection of component degradation. Inspection and testing intervals are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

6. Acceptance Criteria

Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in specific inspection and testing procedures. The procedures confirm component integrity by verifying the absence of aging effects or by comparing applicable parameters to limits based on applicable intended functions established by plant design basis.

7. Corrective Actions

Corrective actions for this program are implemented in accordance with requirements of 10 CFR Part 50, Appendix B.

8. Confirmation Process

This element is discussed in Section B.0.3.

9. Administrative Controls

This element is discussed in Section B.0.3.

10. Operating Experience

Typical inspection results of this program include the following.

Results of inspections of the reactor building crane in 2005 revealed a broken trolley rail hold-down lug bolt. A work order was issued to replace the lug bolt. Identification of degradation and corrective action provide evidence that the program is effective for managing aging effects of material on the turbine building crane, crane rails, and girders.

Inspection of railroad airlock doors elastomer gaskets in 2004 indicated that the elastomers in this airlock were worn. A condition report was issued and the elastomer gaskets were replaced. There was no indication of degradation in the structural members of the airlock doors. Identification of degradation and prompt corrective action provide evidence that the program is effective for managing aging effects for the door seals.

Inspection of railroad airlock doors structural members and elastomer gaskets in 2005 and 2006 revealed that they were in good condition with no signs of corrosion or deterioration of the elastomers. This provides evidence that the program is effective for managing loss of material and cracking and change in material properties in elastomers on the airlock.

Results of inspections of the turbine building crane in 2004 and 2006 did not reveal significant corrosion or wear. This provides evidence that the program is effective for managing loss of material on the turbine building crane, crane rails, and girders.

During 2004, preventive maintenance on the SLC tank drain valve revealed no corrosion or leakage on the external surfaces of the valve. This provides evidence that the program is effective for managing aging effects for the SLC valves.

Preventive maintenance on the standby gas treatment fans in 2006 revealed no corrosion that required any corrective action. This provides evidence that the program is effective for managing aging effects for the standby gas treatment fans.

In 1999 and 2000, the drywell equipment sump drains were disassembled and reassembled with no indication of aging such as erosion or corrosion. This provides evidence that the program is effective for managing aging effects for the sump drains.

Preventive maintenance on jacket water heat exchangers in 2001 revealed pitting on tubes. After evaluation, thirteen tubes were plugged. Also in 2001, pitting on tubes in the lube oil heat exchangers required plugging of five tubes. Identification of degradation and prompt corrective action provide evidence that the program is effective for managing loss of material on the diesel generator heat exchangers. In 2005 degradation due to corrosion was found on the internal surfaces of the exhaust stack. In 2007 corrosion was found on the intercooler waterboxes. No loss of intended function was indicated. These components are being repaired or replaced according to the site Corrective Action Program.

Preventive maintenance on the high pressure core injection room fan in 2005 revealed the flexible rubber connector between the fan and the duct was not secure although no air leakage was found. A condition report was written and the connection was repaired. No other aging effects were observed in the ductwork, vents, fan housing or coil casing. Identification of degradation and prompt corrective action provides assurance that the program is effective for managing loss of material in the HVAC system.

In 2003 and 2005, the suppression chamber exhaust inboard valves were disassembled and reassembled for butterfly valve seal replacement with no indication of aging such as erosion or corrosion. In 2006 and 2007, drain traps in the instrument air system were disassembled, cleaned and examined with no indication of aging such as erosion or corrosion. In 2004 and 2006, air dryer exhaust valves in the instrument air system were disassembled and examined with no indication of aging such as erosion or corrosion. This provides evidence that the program is effective for managing aging effects for the exhaust valves.

Preventive maintenance in 2007 measured the wall thickness of the service air receiver tank using UT procedures to establish a baseline reference for future preventive maintenance. The test results revealed that the tank walls were of acceptable thickness. Preventive maintenance test results confirming the absence of significant wall loss provides evidence that the program is effective for managing loss of material on the instrument air System.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
1. Scope of Program 3. Parameters Monitored or Inspected 4. Detection of Aging Effects 6. Acceptance Criteria	The Periodic Surveillance and Preventive Maintenance Program will be enhanced to include all activities described in the table provided in the program description.
4. Detection of Aging Effects	For each activity that refers to a representative sample, a representative sample will be selected for each unique material and environment combination. The sample size will be determined in accordance with Chapter 4 of EPRI 107514, Age-Related Degradation Inspection Method and Demonstration, which outlines a method to determine the number of inspections required for 90% confidence that 90% of the population does not experience degradation (90/90).

Conclusion

The Periodic Surveillance and Preventive Maintenance Program has been effective at managing aging effects. The Periodic Surveillance and Preventive Maintenance Program assures 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.1.32 REACTOR HEAD CLOSURE STUDS

Program Description

The Reactor Head Closure Studs Program is an existing program that includes inservice inspection (ISI) in conformance with the requirements of ASME Section XI, Subsection IWB, and preventive measures (e.g., rust inhibitors, stable lubricants, appropriate materials) to mitigate cracking and loss of material of reactor head closure studs, nuts, washers, and bushings.

NUREG-1801 Consistency

The Reactor Head Closure Studs Program is consistent with the program described in NUREG-1801, Section XI.M3, Reactor Head Closure Studs, with one exception.

Exceptions to NUREG-1801

The Reactor Head Closure Studs Program is consistent with the program described in NUREG-1801, Section XI.M3, Reactor Head Closure Studs, with the following exception.

Elements Affected	Exception
4. Detection of Aging Effects	NUREG-1801 recommends the use of ASME Section XI, Subsection IWA-2000 to set distance and lighting requirements for VT-2 inspections for leak detection performed during system pressure tests. CNS uses an alternate approach.[1]

Exception Note

1. To prevent the extra scaffolding and radiation exposure needed to meet the distance and lighting requirements of IWA-2210, CNS conducts VT-2 examinations to detect evidence of leakage from pressure retaining components without a distance limitation and prescribes examinations in accordance with IWA-5000. IWA-5000 allows examination of floor areas or equipment surfaces underneath an inaccessible component for evidence of leakage. The NRC Staff has determined that the minimum illumination level and maximum direct examination distance need not be specified in order to perform effective VT-2 examinations. A VT-2 examination is conducted to detect evidence of leakage, and such leakage can be detected effectively beyond the code-specified minimum distance. Leakage can also be detected well under the code-specified minimum illumination level. Even if the general illumination level in the general building area of interest is below the minimum specified illumination level, supplemental spot lighting, if necessary, can be utilized. This alternative to the ASME code has been approved in accordance with the provisions of 10 CFR 50.55a(a)(3) for the 4th interval. To continue the alternative in subsequent intervals during the period of extended operation, approval must be obtained in accordance with 10 CFR 50.55a.

Enhancements

None

Operating Experience

Surface examination of RPV studs and nuts in 2001 during RE20 identified a recordable indication for RPV nuts, two non-recordable indications for RPV studs and a non-recordable for RPV washers. The recordable indication was evaluated as satisfactory. These examinations were done in the previous 10-year interval. Examination of the studs during the current 10-year interval is scheduled for fall of 2009 during RE25. In addition the studs, nuts and washers are examined for cleanliness and damage during each installation of the RPV head. Continuing examination of the studs and nuts and the evaluation of the results provide evidence that the program is effective in managing and detecting cracking and loss of material in the bolting.

The Reactor Head Closure Studs Program detects aging effects using nondestructive examination (NDE) visual, surface 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. The application of these proven methods provides assurance that the effects of aging will be managed such that the Reactor Head Closure Studs Program components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Conclusion

The Reactor Head Closure Studs Program has been effective at managing aging effects. The Reactor Head Closure Studs Program assures 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.1.33 REACTOR VESSEL SURVEILLANCE

Program Description

The Reactor Vessel Surveillance Program is an existing program that manages reduction in fracture toughness of reactor vessel beltline materials to assure that the pressure boundary function of the reactor pressure vessel is maintained through the period of extended operation.

CNS has received NRC approval to use the BWR vessel and internals project (BWRVIP) Integrated Surveillance Program (ISP). The Reactor Vessel Surveillance Program monitors changes in the fracture toughness properties of ferritic materials in the reactor pressure vessel (RPV) beltline region. As BWRVIP-ISP capsule test reports become available for RPV materials representative of CNS, the actual shift in the reference temperature for nil-ductility transition of the vessel material may be updated. In accordance with 10 CFR 50 Appendices G and H, CNS reviews relevant test reports to assure compliance with fracture toughness requirements and P-T limits.

BWRVIP-116, "BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," describes the design and implementation of the ISP during the period of extended operation. BWRVIP-116 identifies additional capsules of the Supplemental Surveillance Program (SSP), their withdrawal schedule, and contingencies to ensure that the requirements of 10 CFR 50 Appendix H are met through the period of extended operation.

NUREG-1801 Consistency

The Reactor Vessel Surveillance Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M31, Reactor Vessel Surveillance.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
5. Monitoring and Trending	If the CNS standby capsule is removed from the reactor vessel without the intent to test it, the capsule will be stored in a manner which maintains it in a condition which would permit its future use, including during the period of extended operation, if necessary.
5. Monitoring and Trending	The CNS Reactor Vessel Surveillance Program will be enhanced to ensure that the additional requirements that are specified in the final NRC safety evaluation for BWRVIP-116 will be addressed before the period of extended operation.

Operating Experience

In 2002 CNS committed to follow the requirements of the BWRVIP Integrated Surveillance Program, BWRVIP-86-A. CNS withdrew surveillance capsules for testing in 2003 and updated the fluence calculation. This resulted in a change in the P-T curves which required a Technical Specification change in 2005.

Conclusion

The Reactor Vessel Surveillance Program has been effective at managing aging effects. The Reactor Vessel Surveillance Program assures 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.1.34 SELECTIVE LEACHING

Program Description

The Selective Leaching Program is a new program that will ensure the integrity of components made of cast iron, bronze, brass, and other alloys exposed to condensation, raw water, steam, treated water, and soil (groundwater) that may lead to selective leaching. The program will include a one-time visual inspection, hardness measurement (where feasible based on form and configuration), or other industry accepted mechanical inspection techniques of selected components that may be susceptible to selective leaching to determine whether loss of material due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended function through the period of extended operation. The selected set or representative sample size will be based on Chapter 4 of EPRI document 107514, Age-Related Degradation Inspection Method and Demonstration, which outlines a method to determine the number of inspections required for 90% confidence that 90% of the population does not experience degradation (90/90). Each group of components with the same material-environment combination is considered a separate population.

This program will be implemented prior to the period of extended operation.

NUREG-1801 Consistency

The Selective Leaching Program will be consistent with the program described in NUREG-1801, Section XI.M33 Selective Leaching of Materials.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Selective Leaching Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the Selective Leaching Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The Selective Leaching Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Selective Leaching Program provides assurance that 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.1.35 SERVICE WATER INTEGRITY

Program Description

The Service Water Integrity Program is an existing program that relies on implementation of the recommendations of GL 89-13 to ensure that the effects of aging on the service water (SW) system will be managed through the period of extended operation. The program includes component inspections for cracking, erosion, corrosion, wear, and blockage and performance monitoring to verify the heat transfer capability of the safety-related heat exchangers cooled by SW. Periodic cleaning and flushing of redundant or infrequently used loops are the methods used to control or prevent fouling within the heat exchangers and loss of material in SW components.

NUREG-1801 Consistency

The Service Water Integrity Program is consistent with the program described in NUREG-1801, Section XI.M20, Open-Cycle Cooling Water System.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

In 2004 and 2005 the reactor equipment cooling system heat exchanger internals were visually examined for corrosion in the water boxes and fouling of the tubes with no aging effects noted. Similar examinations were performed in 2007 to the diesel generator jacket water heat exchangers with no aging effects noted. In 2007, the reactor equipment cooling system heat exchangers were performance tested and shown to have a fouling factor less than the maximum allowable for these heat exchangers. Absence of aging effects provides evidence that the program is effective for managing aging effects.

In 2007, the diesel generator lube oil heat exchangers required that five tubes be plugged due to wall thinning determined by eddy current test. Plugging of these five tubes did not exceed the total tube plugging margin allowed for these lube oil heat exchangers. In 2005 pinhole leaks were found in the backwash piping of the Zurn strainer piping in the SW system. A corrective action plan was placed in effect to periodically replace the piping. In 2002, 2003 and 2007 erosion was found in valve bodies and piping. These components were repaired or replaced according to the site Corrective Action Program. Identification of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects for carbon steel components.

In 2007 cleaning and inspections were performed in the SW bays and the reactor equipment cooling system heat exchangers. SW bays were cleaned and procedures were revised to more effectively monitor this area of the intake structure. Heat exchanger fouling was determined to be within acceptance criteria. NRC biennial heat sink performance inspections were performed in 2004 and 2006. This inspection verified that heat exchanger problems were properly documented, dispositioned, and corrected. In 2006 an industry OE bulletin SER 7-06 was reviewed to address 14 "lessons learned" issues from industry experience related to service water integrity. The service water integrity program was shown to be effectively addressing the issues except for inspection of underground piping and cathodic protection. The Corrective Action Program is being used to enhance the program in these areas. Self assessments have concluded that this program is well documented, captured in controlled procedures, consistent with applicable industry standards, and is implemented with effective interfaces. Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Service Water Integrity Program has been effective at managing aging effects. The Service Water Integrity Program assures 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.1.36 STRUCTURES MONITORING

Program Description

The Structures Monitoring Program is an existing program that performs inspections in accordance with 10 CFR 50.65 (Maintenance Rule) as addressed in Regulatory Guide 1.160 and NUMARC 93-01. Periodic inspections are used to monitor the condition of structures and structural commodities to ensure there is no loss of intended function.

Since protective coatings are not relied upon to manage the effects of aging for structures included in the Structures Monitoring Program, the program does not address protective coating monitoring and maintenance.

NUREG-1801 Consistency

The Structures Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S6, Structures Monitoring Program.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Elements Affected	Enhancements
1. Scope of Program	The Structures Monitoring Program will be enhanced to clarify that the following structures are included in the program. • biological shield wall • control room ceiling support system • crane rails and girders • CRD shootout steel • diesel fuel tank hatch cover • diesel fuel tank retaining wall and slab • drywell fill slab • drywell shell protection panels and jet deflectors • drywell stabilizer supports • foundations (buildings) • guide wall • manholes and duct banks

Elements Affected	Enhancements
1. Scope of Program (continued)	• monorails • new fuel storage vault • office building (or administration building) • oil tank bunker crushed rock fill • pump baffle plates • reactor building loop seal drain caps • reactor building railroad airlock doors • reactor building sump structure • reactor cavity floor and walls • reactor cavity liner • reactor pedestal • sacrificial shield wall (steel portion) • sacrificial shield wall lateral supports • service water pipe slab • shield plugs • spent fuel pool floor and walls • steam tunnel • sumps and sump liners • transformer yard and switchyard support structures and foundations • transmission towers (galvanized), wooden utility towers, wooden utility poles, and foundations • traveling screen casing and associated framing
1. Scope of Program	The Structures Monitoring Program will be enhanced to clarify that in addition to structural steel and concrete, the following commodities are inspected for each structure as applicable. • anchor bolts • anchorage/embedments • base plates • battery racks • beams, columns, floor slabs, and walls (below grade) • blowout panels (including east end of steam tunnel) • cable trays and supports • component and piping supports • conduits and conduit supports

Elements Affected	Enhancements
1. Scope of Program (continued)	• electrical and instrument panels and enclosures • equipment pads and foundations • exterior walls • flood curbs • flood, pressure and specialty doors • flood retention materials (spare parts) • HVAC duct supports • instrument line supports • instrument racks, frames, and tubing trays • manways, hatches, manhole covers, and hatch covers • missile shields • penetration sealant (flood, radiation) • penetration sleeves and sealant (mechanical/electrical not penetrating PC boundary) • pipe whip restraints • seals and gaskets (doors, manways and hatches) • stairs and handrails, platforms, grating, decking, and ladders • support pedestals • vents and louvers
1. Scope of Program 4. Detection of Aging Effects	Guidance will be added to the Structures Monitoring Program to inspect inaccessible concrete areas that are submerged or below grade which may become exposed due to excavation, construction or other activities. CNS will also inspect inaccessible concrete areas when observed conditions in accessible areas exposed to the same environment indicate that significant concrete degradation is occurring.
4. Detection of Aging Effects	The Structures Monitoring Program will be enhanced for inspection of elastomers (seals, gaskets, and roof elastomers) to identify cracking and change in material properties.

Elements Affected	Enhancements
4. Detection of Aging Effects	Guidance to perform an engineering evaluation of groundwater samples to assess aggressiveness of groundwater to concrete on a periodic basis (at least once every five years) will be added to the Structures Monitoring Program. CNS will obtain samples from a well that is representative of the groundwater surrounding below-grade site structures. Samples will be monitored for sulfates, pH and chlorides.
4. Detection of Aging Effects	Guidance for performing visual structural examinations of wood to identify loss of material and change in material properties will be added to the Structures Monitoring Program.
4. Detection of Aging Effects	Guidance for performing visual structural monitoring of the oil tank bunker crushed rock fill to identify loss of form will be added to the Structures Monitoring Program.
7. Corrective Actions	The Structures Monitoring Program will be enhanced to clarify that structures with conditions classified as “acceptable with deficiencies” or “unacceptable” shall be entered into the Corrective Action Program.

<u>Operating Experience</u>

From 2002 through 2007, inspections of buildings, concrete, and structural steel components revealed cracks, spalling, missing grout, minor corrosion (rust), scaling, insulation tears, and minor siding damage. Also, during this period, inspections of roofs indicated tears, missing drain grating, and degraded sealant. An evaluation of these findings concluded the condition did not compromise structural integrity. Identification of degradation and corrective action prior to loss of intended function provide evidence that the loss program is effective for managing aging effects for structural components.

A Maintenance Rule Periodic Assessment covering the period from September 2005 to February 2007 stated there is no known adverse trend in structure performance and concluded the structure inspection program is adequate and effective.

Conclusion

The Structures Monitoring Program has been effective at managing aging effects. The Structures Monitoring Program assures 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.1.37 THERMAL AGING AND NEUTRON IRRADIATION EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL (CASS)

Program Description

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is a new program that will assure reduction of fracture toughness due to thermal aging and reduction of fracture toughness due to radiation embrittlement will not result in loss of intended function. This program will evaluate CASS components in the reactor vessel internals and require non-destructive examinations as appropriate.

This program will supplement reactor vessel internals inspections required by the BWR Vessel Internals Program [B.1.9] and the Inservice Inspection – ISI Program [B.1.19] to manage the effects of loss of fracture toughness due to thermal aging and neutron embrittlement of CASS components.

For pump casings and valve bodies, based on the assessment documented in the letter dated May 19, 2000, from Christopher Grimes, NRC, to Douglas Walters, Nuclear Energy Institute (NEI), screening for susceptibility to thermal aging is not required. The existing ASME Section XI inspection requirements, including the alternative requirements of ASME Code Case N-481 for pump casings, are adequate for all pump casings and valve bodies.

This aging management program includes

(a) identification of susceptible components determined to be limiting from the standpoint of thermal aging susceptibility (i.e., ferrite and molybdenum contents, casting process, and operating temperature) and/or neutron irradiation embrittlement (neutron fluence), and

(b) for each "potentially susceptible" component, aging management is accomplished through either a supplemental examination of the affected component during the period of extended operation, or a component-specific evaluation to determine its susceptibility to reduction of fracture toughness.

This program will be implemented prior to the period of extended operation.

NUREG-1801 Consistency

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will be consistent with the program described in NUREG-1801, Section XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is a new program. Industry operating experience will be considered when implementing this program. Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50 Appendix B quality assurance program.

The CNS program is based on the program description in NUREG-1801, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein. As such, operating experience assures that implementation of the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will be effective for managing aging effects since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program provides assurance that 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.1.38 WATER CHEMISTRY CONTROL – AUXILIARY SYSTEMS

Program Description

There is no corresponding NUREG-1801 program.

The Water Chemistry Control – Auxiliary Systems Program is an existing program that manages loss of material and cracking for components exposed to treated water and steam.

Program activities include sampling and analysis of water in auxiliary condensate drain system components, auxiliary steam system components, and heating and ventilation system components to minimize component exposure to aggressive environments.

The One-Time Inspection Program [B.1.29] utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – Auxiliary Systems Program has been effective at managing aging effects.

Evaluation

1. Scope of Program

Program activities include sampling and analysis of water in auxiliary condensate drain system components, auxiliary steam system components, and heating and ventilation system components to minimize component exposure to aggressive environments.

2. Preventive Actions

This program includes monitoring and control of water in auxiliary condensate drain system components, auxiliary steam system components, and heating and ventilation system components to minimize exposure to aggressive environments, thereby mitigating the effects of aging.

3. Parameters Monitored/Inspected

In accordance with industry recommendations, auxiliary condensate drain system and auxiliary steam system water parameters monitored are pH, conductivity, phosphate, sulfite, and iron.

In accordance with industry recommendations, heating and ventilation systems parameter monitored is sodium nitrite ($NaNO_2$).

4. Detection of Aging Effects

This program manages loss of material and cracking for auxiliary condensate drain system components, loss of material and cracking for auxiliary steam system components, and loss of material for heating and ventilation system components.

The One-Time Inspection Program [B.1.29] for water chemistry describes inspections planned to verify the effectiveness of water chemistry control programs to ensure that significant degradation is not occurring and component intended function is maintained during the period of extended operation.

5. Monitoring and Trending

Values from analyses are archived for long-term trending and review. Trending is not required to predict the extent of degradation since maintaining parameters within acceptance criteria prevents degradation. Operating experience indicates effectiveness in preventing aging effects if parameters are maintained within limits.

6. Acceptance Criteria

In accordance with industry recommendations, acceptance criteria for the auxiliary condensate drain system and auxiliary steam system water are as follows.

pH	$> 9.0, \leq 11.4$
conductivity	< 2100 µmho/cm
phosphate	> 50 ppm
sulfite	> 3 ppm
iron	< 2 ppm

In accordance with industry recommendations, acceptance criteria for the heating and ventilation system are as follows.

sodium nitrite ($NaNO_2$)> 750 ppm

7. Corrective Actions

If acceptance criteria are not met, chemistry parameters are adjusted as appropriate. Additional sampling and verification is performed if necessary. Corrective actions for unacceptable inspection results are identified and implemented in accordance with the CNS 10 CFR Part 50 Appendix B Corrective Action Program.

8. Confirmation Process

This element is discussed in Section B.0.3.

9. Administrative Controls

This element is discussed in Section B.0.3.

10. Operating Experience

From 2003 through 2008, samples were routinely taken from the auxiliary condensate and steam system (heating boilers) and the heating and ventilation system (admin chillers) for analysis. The results for the condensate and steam system indicated no variance from limits in PH or conductivity with occasional variance in iron, phosphate and sulfite. Also, the results for the admin chiller system indicated no variance from limits in conductivity with occasional variance in sodium nitrites. On these occasions of variance, corrective action was taken to bring the variance back into compliance. The routine confirmation of water quality and use of appropriate timely corrective action provide evidence that the program is effective in managing loss of material for applicable components.

In 2006, a self-assessment was performed to address chemistry monitoring, control and evaluation. This assessment prompted training for the process for chemical labeling and permits to assure adequate implementation. It also prompted a review and update of personnel roles and responsibilities, more effective use of the Corrective Action Program and increased attention to reviewing and documenting instrument trends and bias as required by procedure. This self assessment included actions and recommendations which were resolved to upgrade the program to confirm its effectiveness. Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components.

Enhancements

None

Conclusion

The Water Chemistry Control – Auxiliary Systems Program has been effective at managing aging effects. The Water Chemistry Control – Auxiliary Systems Program assures 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.1.39 WATER CHEMISTRY CONTROL – BWR

Program Description

The Water Chemistry Control – BWR Program is an existing program that manages aging effects caused by corrosion and cracking mechanisms. The program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (BWRVIP-130). BWRVIP-130 has three sets of guidelines: one for primary water, one for condensate and feedwater, and one for control rod drive (CRD) mechanism cooling water. EPRI guidelines in BWRVIP-130 also include recommendations for controlling water chemistry in the torus/pressure suppression chamber, condensate storage tank, demineralized water storage tanks, and spent fuel pool.

The Water Chemistry Control – BWR Program optimizes the primary water chemistry to minimize the potential for loss of material and cracking. This is accomplished by limiting the levels of contaminants in the reactor coolant system that could cause loss of material and cracking. Additionally, CNS has instituted hydrogen water chemistry and noble metal chemical addition to limit the potential for IGSCC through the reduction of dissolved oxygen in the treated water.

The One-Time Inspection Program [B.1.29] utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – BWR Program has been effective at managing aging effects.

NUREG-1801 Consistency

The Water Chemistry Control – BWR Program is consistent with the program described in NUREG-1801, Section XI.M2, Water Chemistry.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

During the period from 2002 through 2006, several condition reports were initiated due to adverse trends in parameters monitored by the Water Chemistry Control – BWR Program. Corrective actions were taken within the Corrective Action Program to preclude reaching unacceptable values for the parameters monitored. The routine confirmation of water quality and use of appropriate timely corrective action provide evidence that the program is effective in managing loss of material for applicable components.

In 2002 and 2003, reactor water sulfates were briefly above the chemistry warning limit. These levels are less severe than the EPRI action levels, yet exceeding these levels indicated a potential problem that should be investigated. Parameters were returned to within the prescribed normal operating range in the required time and further corrective action was taken as necessary. The routine confirmation of water quality and use of appropriate timely corrective action provide evidence that the program is effective in managing loss of material for applicable components.

During the period from 2003 through 2005, incidents occurred in which parameters monitored by the Water Chemistry Control – BWR Program exceeded EPRI action level 1 acceptance criteria. This action level is the least of three levels requiring further action. Parameters were returned to the prescribed normal operating range in the required time and further corrective action was taken as necessary. The routine confirmation of water quality and use of appropriate timely corrective action provide evidence that the program is effective in managing loss of material for applicable components.

In 2004 and 2006, elevated reactor water parameters resulted in the Chemistry Performance Index (CPI) reaching greater than 1. This index is an industry standard for prompting action at the least levels of concern. The CPI reached greater than 1 due to different combinations of elevated levels of sulfates and chlorides. Corrective actions were taken to address the excessive CPI. The routine confirmation of water quality and use of appropriate timely corrective action provide evidence that the program is effective in managing loss of material for applicable components.

In 2007, sampling indicated demineralized water system conductivity levels that exceeded action level 1 criteria. Investigation determined the increased conductivity was due to chloride bearing HHC (halogenated hydrocarbons) getting through the reverse osmosis and Electrol Deionization (EDI) phases of the GE/IONICS process stream. An activated charcoal bed was added downstream of the EDI phase of the system. Further testing verified that this modification returned the conductivity to acceptable levels. The routine confirmation of water quality and use of appropriate corrective action provides evidence that the program is effective in managing loss of material for applicable components.

In 2007, conductivity levels that exceeded action level 1 criteria were indicated in the demineralized water storage tank (DWST). Further evaluation indicated that the increase in the DWST total organic carbon and associated minor increase in DWST conductivity was the result of volatile organic compounds introduced during the construction activities associated in the area. When the work activities decreased, the conductivity levels decreased to below the action level 1 criteria. The routine confirmation of water quality and evaluation of results to confirm sources of contamination provides evidence that the program is effective in managing loss of material for applicable components.

In 2005, construction activity dust and debris entering the demineralized water storage tank vent were determined to be the cause of conductivity levels exceeding action level 1 in the tank. An action plan to provide special monitoring along with temporary procedure changes for the system water processing, assured acceptable water quality for the demin water tank. The routine confirmation of water quality and use of appropriate corrective action provides evidence that the program is effective in managing loss of material for applicable components.

SOER 03-02, Managing Core Design Changes was issued to address unsuccessful industry efforts to obtain defect free fuel performance. This SOER required an evaluation of the effects of chemistry changes on core and fuel performance, and the effects of core and fuel design changes on coolant chemistry. This evaluation required a review of chemistry related issues and how these issues are addressed in the Water Chemistry Control – BWR Program. The results of this review and the required responses upgraded and confirmed the effectiveness of the program. Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components.

In 2004 a self assessment was performed to address system corrosion control and data tracking. This assessment reviewed organizational and communication issues such as informing other plant departments of data trending issues. It confirmed improvements in diminishing sulfate chemistry. It also observed continued general compliance with EPRI guidelines for corrosion data in condensate and feedwater chemistry. Actions were assigned to resolve issues concerning communication of trending with other plant groups and an improved lab QA/QC procedure. This self assessment included actions and recommendations which were resolved to upgrade the program to enhance its effectiveness. Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components.

In 2005, a self-assessment was performed to compare the effectiveness of the CNS chemistry program alignment to Entergy chemistry practices. This assessment confirmed the adequacy of qualification and training of CNS chemists. Areas for improvement included the lowering of the threshold for condition report development and setting up communications programs to better use Entergy fleet data for comparison purposes. This self assessment included actions and recommendations which were resolved to upgrade the program by reviewing the adequacy of staffing and providing improved scheduling techniques for chemistry activities. Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Water Chemistry Control – BWR Program has been effective at managing aging effects. The Water Chemistry Control – BWR Program assures 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.1.40 WATER CHEMISTRY CONTROL – CLOSED COOLING WATER

Program Description

The Water Chemistry Control – Closed Cooling Water Program is an existing program that includes preventive measures that manage loss of material, cracking, and fouling for components in closed cooling water systems: diesel generator jacket water (DGJW) system, reactor equipment cooling (REC) system, and turbine equipment cooling (TEC) system. These chemistry activities provide for monitoring and controlling closed cooling water chemistry using CNS procedures and processes based on EPRI guidance for closed cooling water chemistry issued as EPRI TR-1007820, “Closed Cycle Cooling Water Chemistry,” Revision 1, dated April 2004. This guideline supersedes EPRI TR-107396, “Closed Cycle Cooling Water Chemistry Guideline,” Revision 0, issued November 1997, referenced in NUREG-1801. Differences in Revision 0 and Revision 1 are described below.

The purpose of Revision 0 was to assist plants in developing water treatment strategies to protect carbon-steel and copper-containing systems from corrosion. This revision does not provide precise direction, but instead provides broad direction for plants to develop their own closed cooling water chemistry control programs by utilizing the guidance in the report to tailor specific station programs. Revision 0 does not provide tables for "Control Parameters" and "Diagnostic Parameters" with respective sampling frequency and expected values. However, parameters that should be monitored are identified as "Control Parameters" or "Diagnostic Parameters." In general, Revision 0 allows plants a great deal of flexibility in developing their closed cooling water chemistry programs.

Revision 1 is significantly more directive and incorporates action levels with established thresholds for specific actions required. This revision specifically establishes recommended monitoring frequencies and clearly identifies expected parameter values. Revision 0 identifies total organic carbon, dissolved oxygen, total alkalinity, calcium/magnesium, and refrigerants as diagnostic, but these are not described in Revision 1. None of these parameters (or monitoring of them) is considered to have any effect on the long-term health of closed cycle cooling water systems.

Both the EPRI closed cycle cooling water guidelines make a clear distinction between "control parameters" and "diagnostic parameters." Adherence to control parameters is expected, whereas diagnostic parameters are suggested, but can be plant specific. Deviations from EPRI recommended diagnostic parameters are not considered exceptions to NUREG-1801.

Future revisions of the EPRI closed cycle cooling water guidelines will be adopted as required, commensurate with industry standards.

The One-Time Inspection Program [B.1.29] utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – Closed Cooling Water Program has been effective at managing aging effects.

NUREG-1801 Consistency

The Water Chemistry Control – Closed Cooling Water Program is consistent with the program described in NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water System, with one exception.

Exceptions to NUREG-1801

The Water Chemistry Control – Closed Cooling Water Program is consistent with the program described in NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water System, with the following exception.

Elements Affected	Exception
3. Parameters Monitored or Inspected 4. Detection of Aging Effects 5. Monitoring and Trending 6. Acceptance Criteria	NUREG-1801 recommends the use of EPRI report TR-107396 for performance and functional testing guidance. The CNS Water Chemistry Control – Closed Cooling Water Program does not include performance and functional testing.[1]

Exception Note

1. While NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water System endorses EPRI report TR-107396 for performance and functional testing guidance, EPRI report TR-107396 does not recommend that equipment performance and functional testing be part of a water chemistry control program. This appears appropriate since monitoring pump performance parameters is of little value in managing effects of aging on long-lived, passive CCW system components. Rather, EPRI report TR-107396 states in section 5.7 (Section 8.4 in EPRI report 1007820) that performance monitoring is typically part of an engineering program, which would not be part of water chemistry. In most cases, functional and performance testing verifies that component active functions can be accomplished. Passive intended functions of pumps, heat exchangers and other components will be adequately managed by the closed cooling water chemistry and one-time inspection programs through monitoring and control of water chemistry parameters and verification of the absence of aging effects.

Enhancements

None

Operating Experience

In 2002, during routine analysis of the DG-2 jacket cooling water, a high iron concentration level was observed. There was visible iron precipitated in the bottle after preservative was added. Another sample was taken of the DG-2 jacket cooling water and the re-sampled analysis did not confirm the initial results. Further review confirmed that increased flushing prior to sampling was required to assure an acceptable sample. The evidence points to an unrepresentative sample and not a degraded condition. Procedures were revised to double the flush volume to assure a representative sample. Evaluation of sampling practices, and subsequent corrective actions, provides assurance that the program will remain effective in managing loss of material for applicable components.

In 2004, a self assessment was performed to address system corrosion control and data tracking. This assessment reviewed organizational and communication issues such as informing other plant departments of data trending issues and REC and TEC long term trending data (issues of high dissolved oxygen). Recommendations for data tracking and retrieval were evaluated for procedure enhancement. This self assessment included actions and recommendations which were resolved to upgrade the program to enhance its effectiveness. Identification of program deficiencies, and subsequent corrective actions, provide assurance that the program will remain effective for managing loss of material of components.

Conclusion

The Water Chemistry Control – Closed Cooling Water Program has been effective at managing aging effects. The Water Chemistry Control – Closed Cooling Water Program assures 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 REFERENCES

B.2-1 U.S. Nuclear Regulatory Commission, NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 1, September 2005.

B.2-2 U.S. Nuclear Regulatory Commission, NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 1, September 2005.

Appendix C

Response to BWRVIP Applicant Action Items

Cooper Nuclear Station

Of the BWRVIP documents credited for CNS license renewal, the following have NRC safety evaluation (SE) reports for license renewal.

BWRVIP-18-A	BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines
BWRVIP-25	BWR Core Plate Inspection and Flaw Evaluation Guidelines
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 1
BWRVIP-47-A	BWR Lower Plenum Inspection and Flaw Evaluation Guidelines
BWRVIP-48-A	Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines
BWRVIP-49-A	Instrument Penetration Inspection and Flaw Evaluation Guidelines
BWRVIP-74-A	BWR Reactor Vessel Inspection and Flaw Evaluation Guidelines
BWRVIP-76	BWR Core Shroud Inspection and Flaw Evaluation Guidelines
BWRVIP-116	BWR Vessel and Internals Project Integrated Surveillance Program Implementation for License Renewal

License renewal applicant action items identified in the corresponding SE report for each of the above reports are addressed in the following table. BWRVIP documents without SE reports for license renewal have no applicant action items and are therefore not included in the table.

The SE reports contain three common applicant action items, which are addressed only once in the table. For SE reports that contain additional applicant action items, the response is provided separately following the responses to the three common action items.

The SE report for BWRVIP-76 identified no license renewal applicant action items but stated that the report is considered by the NRC staff to be acceptable for use during a facility's current operating term or extended license period. The SE report for BWRVIP-116 also identified no license renewal applicant action items but contained a statement that is pertinent to BWR licensees that will submit a license renewal application; therefore, this statement has been included in the following table.

Action Item Description	Response
Common Action Items from BWRVIP-18-A, -25, -26-A, -27-A, -38, -41 Rev 1, -47-A, -48-A, -49-A, -74-A	
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 CNS has been verified to be bounded by the reports. Additionally, CNS 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 will be reported to the NRC within 45 days of receipt of NRC final approval of the guideline.
BWRVIP-All (2) 10CFR54.21(d) requires that an FSAR 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 FSAR supplement.	The USAR 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	Response
BWRVIP-All (3) 10CFR 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.	No technical specification changes have been identified for CNS based upon the BWRVIP reports.
Additional Action Items	
BWRVIP-18-A, Core Spray Internals Inspection and Flaw Evaluation Guidelines	
BWRVIP-18-A (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.	There were no TLAA issues identified for CNS for BWRVIP-18-A.
BWRVIP-25, 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. Core plate wedges are not installed at CNS; however, NPPD analysis shows that preload clamping condition is not critical to seismic integrity.
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.	CNS has committed to implement the BWRVIP-25 recommendations regarding the rim hold-down bolt inspections, following resolution of a related generic issue by the BWRVIP. The BWRVIP-25 examination has been deferred until the technology is available for examination.

Action Item Description	Response
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.	Accumulated neutron fluence projected to 60 years for CNS exceeds the threshold for IASCC susceptibility for the top guide. However, BWRVIP-26-A does not constitute a TLAA for CNS since it was not used to make any safety determination or as justification for reducing the number of inspections. Since CNS has implemented the inspection requirements of BWRVIP-26-A, the BWR Vessel Internals Program will adequately manage the effects of aging on the top guide for the period of extended operation.
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.	The fatigue analysis of the SLC/core ΔP line for 60 years of operation is a potential TLAA. However, the NRC Safety Evaluation for BWRVIP-27 recognizes this fatigue analysis is not required for all SLC / core ΔP configurations, and BWRVIP-27-A identifies that this fatigue analysis is required only for the low-alloy steel nozzle designs. The CNS SLC/ΔP nozzle is an SB-166 nickel-based alloy insert and is exempt from this fatigue analysis. There are thus no TLAA applicable to CNS in BWRVIP-27-A.
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 [license renewal] should identify and evaluate the projected CUF as a potential TLAA issue.	CNS does not have TLAA associated with lower plenum pressure boundary components.

Action Item Description	Response
BWRVIP-74-A, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines	
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, Inservice Inspection, and One-Time Inspection – Small Bore Piping Programs.
BWRVIP-74-A (5) LR applicants shall describe how each plant-specific aging management program addresses the following elements: (1) scope of program, (2) preventive actions, (3) parameters monitored and 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.	Descriptions of plant-specific aging management programs in Appendix B address the required ten elements.
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 applicants shall contain water chemistry programs based on monitoring and control guidelines for reactor water chemistry that are contained in BWRVIP-29.	The Water Chemistry Control – BWR Program monitors and controls reactor water chemistry in accordance with the guidelines of BWRVIP-130, which supercedes BWRVIP-29.
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.	CNS has received NRC approval to use the BWRVIP ISP. This has been applied to the Reactor Vessel Surveillance Program.

Action Item Description	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 BWRVIP-74 report for the LR period.	Fatigue for the period of extended operation (including discussion of cycles, projected cumulative usage factors, environmental fatigue, etc.) is evaluated as a TLAA in Section 4.3.
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 cool-down operating conditions in the plant at a given EFPY in the LR period.	Development of pressure-temperature limits for the period of extended operation is described as a TLAA in Section 4.2.3. Pressure-temperature limit curves 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.	Evaluation of percent reduction in Charpy upper shelf energy (USE) for beltline materials, plates, and welds for the period of extended operation has been performed. This TLAA is described in Section 4.2.4. The reductions have been shown to remain less than the limiting reductions discussed in BWRVIP-74-A.
BWRVIP-74-A (11) To obtain relief from the in-service 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 for the staff's 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 staff's FSER.	CNS has received relief from the in-service inspection of the circumferential welds for the current ISI interval. If future relief is desired, CNS will officially request this relief for future ISI 10-year intervals including the period of extended operation. This discussion is included in Section 4.2.5.

Action Item Description	Response
BWRVIP-74-A (12) As indicated in the staff's March 7, 2000, letter to Carl Terry, an LR applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in Table 1 of this FSER.	The percent decrease in USE for the limiting axial beltline weld at CNS due to neutron embrittlement has been shown to be bounded by the equivalent margin analysis of BWRVIP-74-A during the period of extended operation. This is evaluated as a TLAA in Section 4.2.5.
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 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.	The method used for the neutron flux calculation is described in Section 4.2.1.
BWRVIP-74-A (14) Components that have indications that have been previously analytically evaluated in accordance with subsection IWB-3600 of Section XI 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.	Flaw evaluations evaluated per IWB-3600 with reference to the current 40-year operating period are discussed in Section 4.3.
BWRVIP-116, BWR Vessel and Internals Project Integrated Surveillance Program Implementation for License Renewal	
BWRVIP-116 BWR licensees that will submit a license renewal application shall implement the ISP(E) by revising their licensing basis to include the approved version of BWRVIP-116 in its application and the proposed licensing basis for the extended period of operation.	CNS has received NRC approval to use the BWRVIP ISP. The additional requirements of the ISP(E) described in BWRVIP-116 have been addressed by the Reactor Vessel Surveillance Program.

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 in this License Renewal Application and the Cooper Nuclear Station Technical Specifications determined that no changes to the Technical Specifications are required.