FERMI 2

LICENSE RENEWAL APPLICATION

PREFACE

The following describes the information location, layout, and editorial conventions in the DTE Electric (DTE) Fermi 2 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," may be referred to by the document number, i.e., NUREG-1801 and 10 CFR 54, respectively. References to the UFSAR are to the Fermi 2 Updated Final Safety Analysis Report, Revision 18.

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 2.2-5. Tables 2.2-1, 2.2-3 and 2.2-4 list mechanical systems, electrical and instrumentation and controls (I&C) systems, and structures, respectively, within the scope of license renewal. Tables 2.2-2 and 2.2-5 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) containments, structures and component supports, and (6) electrical and I&C. 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 2, U.S. Nuclear Regulatory Commission (NRC), December 2010. The tables include comparisons with the evaluations documented in NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 2, U.S. NRC, December 2010, as modified by applicable NRC Interim Staff Guidance (ISG) documents for license renewal.

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 10 CFR 54.3 will remain in effect.

Appendix A, Updated Final 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 UFSAR. The information in Appendix A fulfills the requirements in 10 CFR 54.21(d). Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems," from Revision 2 of NUREG-1800 was used as guidance for the content of the applicable aging management program summaries.

Appendix B, Aging Management Programs and Activities, describes aging management programs and activities that will manage aging effects on components and structures within the scope of license renewal such that they will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. Appendix B contains a comparison of 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 Project (BWRVIP) Applicant Action Items. License renewal application action items identified in the corresponding NRC safety evaluation for each of the reports listed are addressed in this appendix.

Appendix D, Technical Specification Changes, documents 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
AAC	all aluminum conductor
ABH	auxiliary boiler house
AC (or ac)	alternating current
ACI	American Concrete Institute
ACSR	aluminum conductor steel reinforced
AEM	aging effect/mechanism
AERM	aging effects requiring management
AISC	American Institute of Steel Construction
Al	aluminum
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
APRM	average power range monitor
ARI	alternate rod insertion
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
B&PV	Boiler and Pressure Vessel
BADGER	Boron-10 Areal Density Gage for Evaluating Racks
BTP	Branch Technical Position
BWR	boiling water reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Project
C	centigrade
CASS	cast austenitic stainless steel
CCHVAC	control center heating ventilating and air conditioning

Abbreviation or Acronym	Description
CE	conducts electricity
CF	chemistry factor
CFR	Code of Federal Regulations
CII	containment inservice inspection
CLB	current licensing basis
CO_2	carbon dioxide
CRD	control rod drive
CRT	condensate return tank
CST	condensate storage tank
CTG	combustion turbine generator
Cu	copper
CUF	cumulative usage factor
DC (or dc)	direct current
ΔP	differential pressure
ΔRT	reference temperature change
DTE	DTE Electric Company
EAF	environmentally assisted fatigue
ECCS	emergency core cooling system
EDG	emergency diesel generator
EDGSW	emergency diesel generator service water
EECW	emergency equipment cooling water
EESW	emergency equipment service water
EFPY	effective full power years
EHC	electrohydraulic control
EN	enclosure, protection
EPRI	Electric Power Research Institute
EQ	environmental qualification

Abbreviation or Acronym	Description
ESF	engineered safety feature
ext	external
FAC	flow-accelerated corrosion
FB	fire barrier
FC	flow control
FD	flow distribution
F_{en}	environmentally assisted fatigue correction factor
FERC	Federal Energy Regulatory Commission
FHAR	Fire Hazards Analysis Report
FLB	flood barrier
FOST	fuel oil storage tank
FPCCS	fuel pool cooling and cleanup system
FPEE	fire protection engineering evaluation
FSAR	Final Safety Analysis Report
ft-lb	foot-pound
FW	feedwater
GALL	Generic Aging Lessons Learned [NUREG-1801 report]
GE	General Electric
GEH	General Electric Hitachi
GL	Generic Letter
GSI	Generic Safety Issue
GSW	general service water
GSWPH	general service water pump house
HCU	hydraulic control unit
HDPE	high density polyethylene
HELB	high-energy line break

Abbreviation or Acronym	Description
hp	horsepower
HPCI	high pressure coolant injection
HS	heat sink
HVAC	heating, ventilation, and air conditioning
HWC	hydrogen water chemistry
I&C	instrumentation and control
IASCC	irradiation-assisted stress corrosion cracking
ICH	incore housing
ID (or I.D.)	inside diameter
IGSCC	intergranular stress corrosion cracking
ILRT	integrated leakage rate test
IN	insulation; [NRC] Information Notice
INPO	Institute of Nuclear Power Operations
int	internal
IPA	integrated plant assessment
IRM	intermediate range monitor
ISFSI	independent spent fuel storage installation
ISG	Interim Staff Guidance
ISI	inservice inspection
ISP	Integrated Surveillance Program
ksi	kilo-pounds per square inch
KV or kV	kilo-volt
LAS	low alloy steel
LLRT	local leakage rate test
LOCA	loss of coolant accident
LPCI	low pressure coolant injection

Abbreviation or Acronym	Description
LPRM	local power range monitors
LR	license renewal
LRA	license renewal application
MB	missile barrier
MCM	thousand circular mils
MEB	metal enclosed bus
MeV	million electron-volts
µg/cc	micrograms per cubic centimeter
M-G	motor-generator
MIC	microbiologically induced corrosion
MoS_2	molybdenum disulfide
MS	main steam
MSIV	main steam isolation valve
MSR	moisture separator-reheater
MUR/TPO	measurement uncertainty recapture/thermal power optimization
MWe	megawatts-electrical
MWt	megawatts-thermal
NA	neutron absorption; not applicable
NB	nuclear boiler
NBA	nickel-based alloy
n/cm^2	neutrons per square centimeter
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NEIL	Nuclear Electric Insurance Limited
NFPA	National Fire Protection Association
Ni	nickel
NIAS	non-interruptible [control] air supply

Abbreviation or Acronym	**Description**
NPRS	nuclear pressure relief system
NPS	nominal pipe size
NRC	Nuclear Regulatory Commission
NSSS	nuclear steam supply system
OE	operating experience
OEP	Operating Experience Program
OLNC	on-line noble chemistry
OSB	office service building
OVHLL	Overhead Heavy Load and Light Load
PASS	post-accident sampling system
PB	pressure boundary
PCAC	primary containment atmosphere cooling
PCM	primary containment monitoring
PCP	primary containment pneumatics
pH	potential of hydrogen
PH	precipitation-hardened
PM	preventive maintenance
PMME	probable maximum meteorological event
ppb	parts per billion
ppm	parts per million
PRM	process radiation monitoring
PSPM	periodic surveillance and preventive maintenance
P-T	pressure-temperature
PVC	polyvinyl chloride
PWR	pressurized water reactor
QA	quality assurance

Abbreviation or Acronym	**Description**
RBCCW	reactor building closed cooling water
RCIC	reactor core isolation cooling
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RG	Regulatory Guide
RHR	residual heat removal
RHRSW	RHR service water
rpm	revolutions per minute
RPS	reactor protection system
RPV	reactor pressure vessel (synonymous with reactor vessel)
RR	reactor recirculation
RT_{NDT}	reference temperature (nil-ductility transition)
RWCU	reactor water cleanup
RVIM	Reactor Vessel Internals Management
SAMA	severe accident mitigation alternatives
S&PC	steam and power conversion
SBO	station blackout
SCBA	self-contained breathing apparatus
SCC	stress corrosion cracking
SCCW	supplemental cooling chilled water
SER	Safety Evaluation Report
SGTS	standby gas treatment system
SIL	Service Information Letter
SLC	standby liquid control
SNS	support for Criterion (a)(2) equipment
SO_2	sulfur dioxide
SRE	support for Criterion (a)(3) equipment

Abbreviation or Acronym	Description
SRM	source range monitor
SRP	[NUREG-1800, License Renewal] Standard Review Plan
SRV	safety/relief valve
SS	stainless steel; system service [transformer]
SSAHC	shroud support access hole covers
SSC	system, structure, or component
SSR	support for Criterion (a)(1) equipment
STAMR	subject to aging management review
TBCCW	turbine building closed cooling water
TIP	traversing incore probe
TLAA	time-limited aging analysis (analyses)
TRM	Technical Requirements Manual
TWMS	torus water management system
UFSAR	Updated Final Safety Analysis Report
USE	upper-shelf energy
UT	ultrasonic testing
V	volt
VDC	volts, direct current
VFLD	vessel flange leak detection
yr	year
Zn	zinc
0T	inner surface of vessel wall
¼T	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 DTE Electric Company, Fermi 2. The facility operating license for Fermi 2 (Docket Number 50-341, License Number NPF-43) expires at midnight on March 20, 2025. The 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.

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 2, December 2010, 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 (NEI) 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 Fermi 2.

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>

DTE Electric Company (DTE Electric or DTE)

1.1.2 <u>Address of Applicant</u>

DTE Electric Company
One Energy Plaza
Detroit, MI 48226-1279

Address of Nuclear Facility

Fermi 2
6400 N. Dixie Hwy
Newport, MI 48166

1.1.3 Description of Business of Applicants

DTE Electric Company is a subsidiary of DTE Energy Company, a diversified energy company involved in the development and management of energy-related businesses and services nationwide.

DTE Electric Company generates and distributes electricity in southeastern Michigan. The company uses coal, nuclear fuel, natural gas, hydroelectric pumped storage, and renewable sources to generate its electrical output.

DTE Electric Company is the owner of Fermi 2, located in Monroe County, Michigan. DTE Electric Company (hereafter referred to as DTE Electric or DTE) is the holder of Fermi 2 operating license NPF-43 and for purposes of this application is considered the applicant.

1.1.4 Legal Status and Organization

DTE Electric is a direct wholly owned subsidiary of DTE Energy Company. The principal office is located in Detroit, Michigan. DTE Electric and DTE Energy Company are incorporated in the state of Michigan.

DTE Electric is an investor-owned electric utility.

DTE Electric and DTE Energy are not owned, controlled, or dominated by any alien, a foreign corporation, or foreign government. DTE Electric 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 DTE Energy are as follows. Members of the board are all US citizens.

Gerard M. Anderson Chairman	DTE Energy Company One Energy Plaza Detroit, MI 48226
Lillian Bauder Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
David Brandon Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
W. Frank Fountain, Jr. Director	DTE Energy Company One Energy Plaza Detroit, MI 48226

Charles G. McClure, Jr. Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
Gail J. McGovern Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
Mark A. Murray Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
James B. Nicholson Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
Charles W. Pryor, Jr. Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
Josue Robles, Jr. Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
Ruth G. Shaw Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
David A. Thomas Director	DTE Energy Company One Energy Plaza Detroit, MI 48226
James H. Vandenberghe Director	DTE Energy Company One Energy Plaza Detroit, MI 48226

The names and addresses of the executive committee of DTE Energy are as follows. The committee members are all US citizens.

Gerard M. Anderson Chairman of the Board, President and Chief Executive Officer	DTE Energy Company One Energy Plaza Detroit, MI 48226
Steven E. Kurmas President and Chief Operating Officer – DTE Energy	DTE Energy Company One Energy Plaza Detroit, MI 48226

Sandra Ennis Vice President – Corporate Communications	DTE Energy Company One Energy Plaza Detroit, MI 48226
Steven Mabry President – Energy Trading-FERC[1] Gas	DTE Energy Company One Energy Plaza Detroit, MI 48226
David E. Meador Vice Chairman and Chief Admin Officer	DTE Energy Company One Energy Plaza Detroit, MI 48226
Lisa Muschong Corporate Secretary – Chief of Staff	DTE Energy Company One Energy Plaza Detroit, MI 48226
Gerardo Norcia President and Chief Operating Officer – DTE Electric/ GSP	DTE Energy Company One Energy Plaza Detroit, MI 48226
Peter Oleksiak Senior Vice President and Chief Financial Officer	DTE Energy Company One Energy Plaza Detroit, MI 48226
Bruce Peterson Senior Vice President and General Counsel-FERC Gas	DTE Energy Company One Energy Plaza Detroit, MI 48226
David Ruud President – Power & Industrial	DTE Energy Company One Energy Plaza Detroit, MI 48226
Larry Steward Senior Vice President – Human Resources	DTE Energy Company One Energy Plaza Detroit, MI 48226

1. Federal Energy Regulatory Commission

The names and addresses of the board of directors of DTE Electric are as follows. Members of the board are all US citizens.

Gerard M. Anderson Director	DTE Electric Company One Energy Plaza Detroit, MI 48226
David E. Meador Director	DTE Electric Company One Energy Plaza Detroit, MI 48226
Lisa A. Muschong Director	DTE Electric Company One Energy Plaza Detroit, MI 48226
Bruce D. Peterson Director	DTE Electric Company One Energy Plaza Detroit, MI 48226

The names and addresses of selected officers of DTE Electric are as follows. These officers are all US citizens.

Gerard M. Anderson Chairman of the Board, President and Chief Executive Officer	DTE Electric Company One Energy Plaza Detroit, MI 48226
Joseph Plona Senior Vice President and Chief Nuclear Officer	DTE Electric Company One Energy Plaza Detroit, MI 48226
Lisa Muschong Corporate Secretary – Chief of Staff	DTE Electric Company One Energy Plaza Detroit, MI 48226
Gerardo Norcia President and Chief Operating Officer – DTE Electric/GSP	DTE Electric Company One Energy Plaza Detroit, MI 48226
Peter Oleksiak Senior Vice President and Chief Financial Officer	DTE Electric Company One Energy Plaza Detroit, MI 48226

1.1.5 Class and Period of License Sought

The applicant requests renewal of the facility operating license for Fermi 2 (facility operating license Docket Number 50-341, License Number NPF-43) for a period of 20 years. The license was issued under Section 104(b) of the Atomic Energy Act of 1954 as amended. License renewal would extend the Fermi 2 facility operating license from midnight, March 20, 2025, to midnight, March 20, 2045.

The facility will be used to generate electricity for distribution to the DTE Electric service area. 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.

Michigan Public Service Commission
PO Box 30221
Lansing, MI 48909

U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

1.1.8 Local News Publications

The trade and news publications which circulate in the area surrounding Fermi 2, 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.

The Monroe News
20 W. First Street
Monroe, MI 48161

The News-Herald
One Heritage Drive, Suite 100
Southgate, MI 48195

The Detroit Free Press
615 W. Lafayette Blvd.
Detroit, MI 48226

The Toledo Blade
541 N. Superior Street
Toledo, OH 43660

The Detroit News
A Media News Group Company
615 W. Lafayette Blvd.
Detroit, MI 48226

1.1.9 Conforming Changes to Standard Indemnity Agreement

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 renewed license." Item 3 of the Attachment to the current indemnity agreement (No. B-20) for Fermi 2, as revised by Amendment No. 27, lists Fermi 2 facility operating license number NPF-43 with no expiration date for the license. Therefore, no changes to the indemnity agreement are deemed necessary as part of this application. Should the license number be changed by NRC upon issuance of the renewed license, DTE requests that NRC amend the indemnity agreement to include conforming changes to Item 3 of the attachment and other affected sections of the agreement.

1.1.10 Restricted Data Agreement

This application does not contain restricted data or national security information, and the applicant does not expect that any activity under the renewed license for Fermi 2 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 10 CFR Parts 25 or 95, respectively.

1.2 PLANT DESCRIPTION

The Fermi 2 power plant is located on the western shore of Lake Erie at Lagoona Beach, Frenchtown Township, in Monroe County, Michigan. The plant is approximately 8 miles east-northeast of Monroe, Michigan; approximately 28 miles southwest of downtown Detroit, Michigan; and approximately 26 miles northeast of downtown Toledo, Ohio. The site is bounded on the north by Swan Creek, on the east by Lake Erie, on the south by Pointe Aux Peaux Road, and on the west by Toll Road.

Fermi 2 is a single-cycle, forced-circulation boiling water reactor (GE-BWR 4). General Electric Company (GE) furnished the nuclear steam supply system (NSSS). The Fermi 2 containment is a Mark I pressure-suppression concept, with a steel plate pressure vessel consisting of a light bulb-shaped drywell and a torus-shaped pressure suppression chamber. The design power rating for Fermi 2 is 3486 MWt, with a turbine-generator net electrical output of approximately 1170 MWe.

The principal structures of the station consist of the reactor building, turbine building, auxiliary building, radwaste building, residual heat removal (RHR) complex, two natural-draft hyperbolic circulating water cooling towers, independent spent fuel storage installation (ISFSI), and office buildings.

The decommissioned Enrico Fermi Atomic Power Plant (Fermi 1) is within the Fermi 2 Owner Controlled Area. Fermi 1 (Facility Operating License DPR-9) was a sodium-cooled fast breeder reactor. It is permanently shut down, in SAFSTOR status. The nuclear fuel has been shipped offsite.

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 Fermi 2 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 control (I&C) systems.

Table 2.0-1 gives the expanded 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, flued heads and reducers).

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	Enclosure, protection	Provide enclosure, shelter or protection for in-scope equipment (including high-energy line break (HELB), radiation shielding, pipe whip restraint, and thermal shielding).
FB	Fire barrier	Provide rated fire barrier to prevent 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 (SBO) or design basis accidents (includes source of cooling water for plant shutdown).
HT	Heat transfer	Provide ability to transfer heat.
IN	Insulation	Insulate and support an electrical conductor (electrical) or provide insulating characteristics to reduce heat transfer (structural).
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	Plate-out	Provide holdup and plate-out of fission products.
PR	Pressure relief	Provide over-pressure protection.

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

Abbreviation	Intended Function	Definition
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)).
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.
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 coolant system components.

2.1 SCOPING AND SCREENING METHODOLOGY

2.1.1 Scoping Methodology

The license renewal rule, 10 CFR 54 (Ref. 2.1-1), defines the scope of license renewal. Section 54.4(a) requires systems, structures, and components (SSCs) to be included in the license renewal process if they are—

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

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

(ii) The capability to 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* (Ref. 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 within the scope of license renewal for Fermi 2 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 Fermi 2 Central Component (CECO) database was used to develop a list of plant systems. The equipment database is a controlled list of plant systems and components, with each component assigned to one plant system.

For mechanical system scoping, a system is defined as the collection of mechanical 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 and for the determination of system safety functions. Tables 2.2-1 and 2.2-2 list the mechanical systems evaluated for inclusion within the scope of license renewal.

Systems defined in the Updated Final Safety Analysis Report (UFSAR) do not necessarily correspond to equipment database system codes. The system descriptions in Section 2.3 explain, as necessary, how the equipment database system codes relate to the UFSAR systems.

Structural components included in system codes with mechanical equipment, such as snubbers, and structural commodities associated with mechanical systems, such as pipe hangers and insulation, are evaluated as structural components and bulk commodities.

For the purposes of system level scoping, plant electrical and I&C systems are included within the scope of license renewal by default. Electrical and I&C components in mechanical systems are included in the evaluation of electrical and I&C components, regardless of whether the mechanical system is included in scope. Intended functions for electrical and I&C systems are not identified since the bounding (i.e., included by default) scoping approach makes it unnecessary to determine if an electrical and I&C system has an intended function. Switchyard equipment, which is not part of the plant's electrical and I&C systems, was reviewed for station blackout (SBO) intended functions based on NRC guidance in NUREG-1800, Section 2.5.2.1.1 (Ref. 2.1-2). For further discussion of Fermi 2 scoping for SBO, see Section 2.1.1.3.5. See Section 2.5 for additional information on electrical scoping. Table 2.2-3 lists the electrical and I&C systems included within the scope of license renewal.

As the starting point for structural scoping, a list of plant structures was developed from a review of the UFSAR, plant layout drawings, Fire Hazard Analysis (Appendix 9A.4 of the UFSAR), design basis documents, and Maintenance Rule Basis documents. The structures 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., foundations for freestanding tanks and electrical manholes). Tables 2.2-4 and 2.2-5 list the plant structures evaluated for inclusion within the scope of license renewal.

Intended functions for structures and mechanical systems were identified based on reviews of applicable plant licensing and design documentation. Documents reviewed included the UFSAR, site Technical Specifications, the Fire Hazards Analysis (Appendix 9A.4 of the UFSAR), the Safe

Shutdown Analysis, Maintenance Rule Basis documents, design basis documents, and 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). The results of these evaluations for plant system 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 50.49(b)(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).

A Fermi 2 engineering procedure provides the criteria and methodology for determining and evaluating the safety and quality classification of systems, structures and components. The procedure defines safety-related, or Quality Assurance (QA) Level 1, to include the following:

> Those structures, systems, and components that are relied upon to remain functional during and following design basis events to assure:
>
> 1. The integrity of the reactor coolant pressure boundary,
>
>   OR
>
> 2. The capability to shut down the reactor and maintain it in a safe condition,
>
>   OR
>
> 3. The capability to prevent or mitigate the consequences of an incident which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in 10 CFR 50.34(a)(1) or 10 CFR 100.11 as applicable.

The procedure does not explicitly define design basis events; however, the safety-related criteria are not limited to accidents and transients described in Chapter 15 of the UFSAR. Consistent with the definition of design basis events as described by 10 CFR 50.49(b)(1), the design basis document describing design basis events combinations includes accidents and plant transient events presented in Chapter 15 of the UFSAR, plus other plant events such as internal missiles, tornado (external missiles and wind), external flood (waves and storm), and seismic events.

The three functional criteria of the definition of safety-related are essentially the same as the definition used for safety-related SSC in 10 CFR 54.4(a)(1), with one relevant difference. The Fermi 2 definition does not refer to the exposure guidelines of Section 50.67(b)(2). The exposure guidelines of 10 CFR 50.67(b)(2) address the alternate source term, which Fermi 2 has credited in the fuel handling accident and loss of coolant accident (LOCA) analyses. A review was performed of the systems and components that are credited for this limited use of 10 CFR 50.67 to ensure the applicable systems and components were included within the scope of the license renewal. For the fuel handling accident analysis, no new SSC functional requirements beyond those established to meet the guidelines of 10 CFR 100 were credited for the application of the alternate source term. For the LOCA analysis, one new SSC functional requirement had been established when the alternate source term had been credited. The standby liquid control (SLC) system was credited with post-LOCA pH control of the suppression pool by injection of sodium pentaborate. Although the components of the SLC system are not all classified as QA Level 1, the system was determined capable of supporting the new safety function. All SLC system components required to support this function are included within the scope of license renewal.

With the exception of the reference to the exposure guidelines of Section 50.67(b)(2), the Fermi 2 definition of safety-related is consistent with the definition of safety-related SSC in 10 CFR 54.4(a)(1). Those SSC with intended safety functions for license renewal are therefore classified as safety-related (QA Level 1). The Fermi 2 equipment database maintains the controlled component level list of quality (QA Level) classifications.

Consistent with this functional definition of safety-related, the Fermi 2 QA Level 1 classification applies to SSC that perform a safety function. However, the QA Level 1 classification also conservatively applies to an extended set of components beyond those that support a safety function. For example, most seismically qualified mechanical components beyond the boundary of components required to support a safety function are also conservatively classified as QA Level 1.

Mechanical systems that rely on mechanical components to perform a safety function are included within the scope of license renewal. Mechanical system safety functions were obtained from the UFSAR and also from design basis documents for those systems for which a design basis document was written. Mechanical systems whose only safety-related components are electrical and I&C components or structural components are not included in scope for this criterion; however, the electrical and I&C 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 UFSAR, the maintenance rule basis documents, and the Fire Hazards Analysis. Structures that perform a safety function are within the scope of license renewal on the basis of criterion 10 CFR 54.4(a)(1).

As described in Section 2.1.1, plant electrical and I&C systems are included within the scope of license renewal by default.

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 (Ref. 2.1-6). Consideration of hypothetical failures that could result from system interdependencies that are not part of the current licensing basis (CLB) 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 in physical proximity to a safety-related SSC.

2.1.1.2.1 Functional Failures of Nonsafety-Related SSCs

At Fermi 2, systems and structures required to perform a function to support a safety function are classified as safety-related and have been included in the scope of license renewal per Section 2.1. For the exceptions where nonsafety-related equipment is required to remain functional to support a safety function (e.g., support the fuel pool cooling and cleanup system in removing decay heat from fuel assemblies stored in the fuel pools), 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 (Ref. 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

For nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems), components within the scope of license renewal include the connected piping and supports up to and including the first seismic or equivalent anchor beyond the safety-nonsafety interface, or up to a point determined by alternative bounding criteria (such as a base-mounted component, flexible connection, or the end of a piping run). See Section 2.1.2.1.2 for further discussion of screening these components.

(2) <u>*Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs*</u>

Spatial interactions can occur as (a) physical impact or flooding; (b) pipe whip, jet impingement, or harsh environments (such as caused by a HELB); or (c) spray or leakage.

(a) 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 physical support, shelter, and protection for safety-related systems, structures, and components," 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).

(b) 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 UFSAR and other relevant site documentation. 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 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 to provide reasonable assurance that those assumptions remain valid through the period of extended operation.

(c) 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 within 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 used 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, or 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.

Abandoned equipment that has not been verified to be isolated and drained and that is located in a space with safety-related equipment is included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The scope of the abandoned equipment was determined from discussions with site personnel, from the site database, and by reviewing documents, including piping and instrumentation diagrams, design change notices, and system and structure scoping results.

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.

As described in Section 2.1.1, plant electrical and I&C systems are included in the scope of license renewal by default.

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, Fermi 2 fire protection documents were reviewed.

UFSAR Section 9.5.1 describes the fire protection system and Section 9A describes the fire protection program. The fire protection program has been developed to satisfy the requirements of 10 CFR 50 and Branch Technical Position BTP-APCSB 9.5-1, Appendix A, and 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:

- Fire Protection Program as described in Appendix 9A of UFSAR, including Appendix 9A.5, Point by Point Comparison, and the Engineering Support Conduct Manual procedure for the Fire Protection Program.
- Fire Hazards Analysis Report (FHAR) (Appendix 9A.4 of UFSAR).
- Analysis of Safe Shutdown (Appendix 9A.3 of UFSAR).
- Appendix R Equipment and Cable Justifications.
- Technical Requirements Manual.

The Fire Protection Program Plan as required by 10 CFR 50.48 is included in the Fermi 2 UFSAR and the Engineering Support Conduct Manual procedure for the Fire Protection Program. The Fire Protection Program Plan discusses the purpose, design, implementation and maintenance of the program. It states the fire protection objectives and defines the program bases and key elements. The Fire Protection Program Plan identifies the fundamental fire protection documents, describes the method of compliance, and provides an explanation of the organization, responsibilities, and administrative controls which comprise the Fire Protection Program. Appendix 9A.5 of the UFSAR contains a point-by-point comparison with Appendix A to NRC Branch Technical Position APCSB 9.5-1.

The plant FHAR compares the design of the program with the performance-related fire protection objectives, such as combustible loading, adequacy of suppression systems, and fire barriers. The FHAR documents by fire zone the presence of safety-related equipment and safe shutdown systems, components, and devices.

The Analysis of Safe Shutdown describes Fermi 2 strategy and corresponding analysis that assures safe shutdown of the plant in the event of a fire in accordance with 10 CFR 50, Appendix R. The Appendix R Equipment and Cable Justifications calculation identifies those systems and components necessary to shutdown the plant and maintain it in a safe shutdown condition. The Technical Requirements Manual (TRM) contains operational system testing and surveillance requirements.

Based on the review of the Fermi 2 current licensing bases for fire protection, the system intended functions performed in support of 10 CFR 50.48 requirements were determined. Section 2.3 contains the results of the review of the Fermi 2 mechanical systems and identifies systems that contain passive mechanical components that support at least one of the following required functions:

- Provide fire protection in accordance with 10 CFR 50 and BTP APCSB 9.5-1, Appendix A, and 10 CFR 50, Appendix R.
- Operate as defined by the safe shutdown capability analysis to assure safe shutdown of the plant in the event of a fire in accordance with 10 CFR 50, Appendix R (such as the nuclear boiler system, RHR system, reactor core isolation cooling (RCIC) system).

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). Section 2.4 contains the results of the scoping review for the Fermi 2 structures.

As described in Section 2.1.1, plant electrical and I&C systems are included in the scope of license renewal by default.

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

Section 50.49 of 10 CFR 50 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 Engineering Support Conduct Manual procedure for the Conduct of the Environmental Qualification (EQ) Program controls the maintenance of the list of EQ components contained within the equipment database. The list of EQ components identifies electrical equipment and components that are required to function during and subsequent to design basis events.

As described in Section 2.1.1, plant electrical and I&C systems are included in the scope of license renewal by default. 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, Fermi 2 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. The Fermi 2 UFSAR identifies system functional requirements for 10 CFR 50.62.

Based on Fermi 2 current licensing bases for ATWS, mechanical system intended functions performed in support of 10 CFR 50.62 requirements were determined.

The individual structure scoping evaluations in Section 2.4 contain the results of the review for the Fermi 2 structural systems. Structures providing support, shelter or protection to equipment meeting the criterion of 10 CFR 54.4(a)(3) based on the requirements of 10 CFR 50.62 are considered to be within the scope of license renewal based on 10 CFR 54.4(a)(3).

As described in Section 2.1.1, plant electrical and I&C systems are included in the scope of license renewal by default. Consequently, electrical and I&C equipment that supports the requirements of 10 CFR 50.62 is included in the scope of license renewal.

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

Section 50.63 of 10 CFR 50, "Loss of All Alternating Current Power," requires that each light-water-cooled nuclear power plant be able to withstand and recover from an SBO. As defined by 10 CFR 50.2, an SBO is the loss of offsite power and 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.

Section 8.4 of the UFSAR summarizes the licensing bases for SBO at Fermi 2. Fermi 2 has developed a four-hour coping analysis, which credits the availability of combustion turbine generator (CTG) 11-1 as an alternate AC power source within one hour, 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. Individual system scoping evaluations in Section 2.3 contain the results of the review for Fermi 2 mechanical systems.

Based on NRC guidance in NUREG-1800, Section 2.5.2.1.1 (Ref. 2.1-2), 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 SBO (10 CFR 50.63).

The individual structure scoping evaluations in Section 2.4 contain the results of the review for the Fermi 2 structures. Structures providing support, shelter or protection to equipment meeting the criterion of 10 CFR 54.4(a)(3) based on the requirements of 10 CFR 50.63 or the restoration of offsite power are considered to be within the scope of license renewal based on 10 CFR 54.4(a)(3).

As described in Section 2.1.1, plant electrical and I&C systems are included in the scope of license renewal by default. Consequently, electrical equipment that supports the requirements of 10 CFR 50.63 is included in the scope of license renewal. Section 2.5 contains the results of the review for electrical and I&C systems.

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 [i.e., passive components]. 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 [i.e., long-lived components].

(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 current licensing basis for the period of extended operation.

NEI 95-10 (Ref. 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 Fermi 2 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 support an intended function do not require aging management review if they are either active or subject to replacement based on a qualified life.

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 an 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 could impact a safety function. A physical failure is one where a safety function could be impacted by the loss of structural or mechanical integrity of an SSC.

As discussed in Section 2.1.1.2, physical interactions 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).

- Nonsafety-related systems or components with the potential for spatial interaction with safety-related SSCs.

For directly connected components, appropriate piping and instrument diagrams for the systems were reviewed to identify safety-to-nonsafety interfaces. Piping isometrics were also used to identify seismic anchors and equivalent anchors (restraints or supports) when required to establish scope boundary. For each interface, the boundary was determined by one of the following:

(1) The first seismic anchor, which is defined as a device or structure that ensures that forces and moments are restrained in three orthogonal directions.

(2) An equivalent anchor (restraints or supports), which is defined as a boundary point that encompasses at least two supports in each of three orthogonal directions.

(3) A boundary determined using the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a flexible connection or the end of a piping run (such as a vent or drain line) or up to and including a base-mounted component.

(4) If the boundary could not be determined in accordance with (1), (2), or (3) above, then the boundary beyond the interface was determined from review of site-specific supporting analyses.

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 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). (Ref. 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.

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

To ensure the nonsafety-related portions of high-energy lines were included in the 10 CFR 54.4(a)(2) review, the Fermi 2 UFSAR and associated site documentation were reviewed.

Many 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 Fermi 2 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 to provide reasonable assurance that those analysis assumptions remain valid through the period of extended operation.

Components in high-energy lines are included in the appropriate system table for the 10 CFR 54.4(a)(2) review (Sections 2.3.1.7, 2.3.2.8, 2.3.3.17, and 2.3.4.3).

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 water, oil, or steam 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.

- Auxiliary building
- Condensate storage tanks foundation and retaining barrier
- Manholes and duct banks
- Primary containment structure
- Reactor building
- Residual heat removal complex
- Turbine building

The scope of abandoned equipment was determined from discussions with site personnel, from the site database, and by reviewing documents, including piping and instrumentation diagrams (where hash marks and notes denote abandoned equipment), design change notices, and system and structure scoping results.

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.

The license renewal drawings indicate continuations to other drawings where applicable. Not all continuation drawings are suitable as license renewal drawings. Where a drawing continuation includes the note, "Not an LRA Drawing," it indicates that the referenced drawing is not suitable as a license renewal drawing.

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 site design documents (UFSAR, design basis documents, design specifications, site procedures and drawings, etc.) 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 (Ref. 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 electrical and I&C aging management review evaluates commodity groups containing components with similar characteristics. Screening applied to commodity groups determines which electrical and I&C 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. Fermi 2 electrical commodity groups were compared to the NEI 95-10, Appendix B electrical and I&C commodity groups. Fermi 2 passive electrical commodity groups correspond to Items 77 and 87 of the NEI 95-10 passive electrical and I&C commodity groups. Items 77 and 87 of NEI 95-10, Appendix B 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):

- Cables and connections, bus, electrical portions of electrical and I&C penetration assemblies, fuse holders outside of cabinets of active electrical components.

Switchyard commodities and metal-enclosed bus commodities are not included in the Fermi 2 equipment database. However, as discussed in Section 2.5, the following additional commodities meet the 10 CFR 54.21(a)(1)(i) screening criterion:

- High voltage insulators (corresponds to Item 87 of NEI 95-10, Appendix B).
- Switchyard bus and connections (corresponds to Item 77 of NEI 95-10, Appendix B).
- Transmission conductors and connections (corresponds to Item 77 of NEI 95-10, Appendix B).

The commodity group "cables and connections, bus, electrical portions of electrical and I&C penetration assemblies, fuse holders outside of cabinets of active electrical components" is subdivided as shown in Table 2.5-1. Other Fermi 2 electrical and I&C commodity groups are active and do not require aging management review.

Electrical and I&C components whose primary function is electrical can also have a mechanical pressure boundary function. These components include 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 electrical and I&C 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 <u>Long-Lived Screening</u>

Electrical components and electrical and I&C penetration assemblies included in the EQ program per 10 CFR 50.49 are subject to replacement based on their qualified life and thus are not long-lived. Therefore, in accordance with 10 CFR 54.21(a)(1)(ii), EQ electrical components are not subject to aging management review. EQ electrical 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 Component 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. These consumable items are not subject to aging management review.

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 equipment performance criteria at Fermi 2 comply with the applicable safety standards (e.g., BTP-APCSB 9.5.1; National Fire Protection Association document NFPA-10 for fire extinguishers, fire hoses, and SCBA air cylinders; and 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 repaired or replaced if they do not pass the test or inspection. Fire protection and radiation 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 within the scope of license renewal, they do not require an aging management review.

2.1.3 Interim Staff Guidance Discussion

As discussed in NEI 95-10 (Ref. 2.1-6), the NRC has encouraged applicants for license renewal to address proposed interim staff guidance (ISGs) in the LRA. The majority of license renewal-related ISGs have been resolved (Ref. 2.1-8, 2.1-9) with the issuance of revisions to the license renewal guidance documents NUREG-1800 (Ref. 2.1-2), NUREG-1801 (Ref. 2.1-3), RG 1.188 (Ref. 2.1-4), and NEI 95-10. The remaining relevant ISGs are addressed as follows.

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

This ISG recommends that applicants for license renewal follow the guidance provided in NEI 05-01 (Ref. 2.1-7) when preparing SAMA analyses as part of a license renewal application. This guidance was followed in preparing the Fermi 2 SAMA analysis presented in Appendix E of this application.

LR-ISG-2011-01 Aging Management of Stainless Steel Structures and Components in Treated Borated Water (Revision 1)

This ISG recommends guidance for aging management presented as revisions to selected tables of NUREG-1800 (Ref. 2.1-2) and NUREG-1801 (Ref. 2.1-3). The revised guidance has been considered in the integrated plant assessment and is reflected in the aging management results presented in Section 3.

LR-ISG-2011-03 Generic Aging Lessons Learned (GALL) Report Revision 2 [Aging Management Program] AMP XI.M41, "Buried and Underground Piping and Tanks"

This ISG provides expanded guidance for managing the effects of aging of buried and underground piping and tanks within the scope of license renewal. This guidance is presented as revisions to NUREG-1800 (Ref. 2.1-2) and NUREG-1801 (Ref. 2.1-3). The revised guidance has been considered in the integrated plant assessment and is reflected in the aging management results presented in Section 3 and the aging management program description presented in Appendix B (Section B.1.4).

LR-ISG-2011-05 Ongoing Review of Operating Experience

This ISG establishes a framework for the consideration of operating experience concerning aging management and age-related degradation during the term of a renewed operating license. The ISG provides interim revisions to NUREG-1800 (Ref. 2.1-2) and NUREG-1801 (Ref. 2.1-3) to present new NRC review criteria for the operating experience review program. The revised guidance is reflected in the description of the process for the review of operating experience presented in Appendix B (Section B.0.4).

LR-ISG-2012-01 Wall Thinning due to Erosion Mechanisms

This ISG provides additional guidance for managing the effects of wall thinning due to aging mechanisms other than flow-accelerated corrosion (FAC). The revised guidance has been considered in the integrated plant assessment and is reflected in the aging management results presented in Section 3 and the aging management program descriptions presented in Appendix B (Section B.1.20).

LR-ISG-2012-02 Aging Management of Internal Surfaces, Service Level III and Other Coatings, Atmospheric Storage Tanks, and Corrosion under Insulation

This ISG provides proposed guidance on a variety of topics as indicated by the title. Due to the timing of the ISG issuance, it was not feasible to include guidance from all parts of this ISG into the development of the Fermi 2 LRA. Guidance from the following sections of this ISG was included.

Section B: Representative Minimum Sample Size for XI.M38.

Section D: Revisions to the Scope and Inspection Recommendations of XI.M29.

Section F: External Volumetric Examination of Internal Piping Surfaces of Underground Piping Removed from XI.M41.

Section G: Specific Guidance for Use of the Pressurization Option for Inspecting Elastomers in XI.M38.

Section H: Key Miscellaneous Changes.

LR-ISG-2013-01 (Draft) Aging Management of Loss of Coating Integrity for Internal Service Level III (Augmented) Components

This ISG provides proposed guidance related to managing loss of coating integrity. Due to draft nature of the ISG and the timing of its issuance, it was not feasible to include recommended activities from this ISG into the Fermi 2 LRA.

2.1.4 Generic Safety Issues

In accordance with the guidance in NEI 95-10 (Ref. 2.1-6), review of NRC generic safety issues (GSIs) as part of the license renewal process is required to satisfy the finding required by 10 CFR 54.29. GSIs designated as unresolved safety issues (USIs) and High- and Medium-priority issues in NUREG-0933, Appendix B (Ref. 2.1-5), that involve aging effects for structures and components subject to an aging management review or time-limited aging analysis evaluations are to be addressed in the LRA. A review of the version of NUREG-0933 current six months prior to the license renewal application submittal (Ref. 2.1-5) determined that there were no outstanding USIs or High- or Medium-priority GSIs. Two GSIs designated as Active, 186 and 193, were reviewed to assure they did not involve aging effects for structures and components subject to an aging management review or time-limited aging analysis evaluations.

Item 186, Potential Risk and Consequences of Heavy Load Drops in Nuclear Power Plants, involves issues related to crane design and operation. Aging effects are not central to these issues. The issue does not involve time-limited aging analysis evaluations, including typical crane-related TLAAs such as cyclic loading analyses.

Item 193, BWR [Emergency Core Cooling System] ECCS Suction Concerns, addresses the possible failure of low pressure emergency core cooling systems due to unanticipated, large quantities of entrained gas in the suction piping from suppression pools in BWR Mark I containments following a LOCA without a loss of offsite power. Aging effects are not relevant to this postulated condition. The issue does not involve time-limited aging analysis evaluations.

Therefore, there are no GSIs involving aging effects for structures and components subject to an aging management review or time-limited aging analysis evaluations that are relevant to the Fermi 2 license renewal process.

2.1.5 Conclusion

The methods described in Sections 2.1.1 and 2.1.2 were used at Fermi 2 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 *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants.* NUREG-1800. U.S. Nuclear Regulatory Commission (NRC). Revision 2. December 2010.

2.1-3 *Generic Aging Lessons Learned (GALL) Report.* NUREG-1801. U.S. NRC. Revision 2. December 2010.

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

2.1-5 *Resolution of Generic Safety Issues (Formerly entitled "A Prioritization of Generic Safety Issues"), NUREG-0933.* (Appendix B, Applicability of NUREG-0933 Issues to Operating and Future Reactor Plants, Revision 25, September 30, 2011). U.S. NRC. December 2011.

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

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

2.1-8 Kuo, P. T. (NRC) to A. Marion (NEI) and D. Lochbaum (Union of Concerned Scientists), Summary of the 2001–2005 Interim Staff Guidance for License Renewal. Letter dated February 6, 2007.

2.1-9 *Disposition of Public Comments and Technical Bases for Changes in the License Renewal Guidance Documents NUREG-1801 and NUREG-1800.* NUREG-1950. Table A-8, Summary of Changes to the Updated License Renewal Documents as a Result of License Renewal Interim Staff Guidance (LR-ISG). U.S. NRC. April 2011.

2.2 PLANT LEVEL SCOPING RESULTS

Tables 2.2-1, 2.2-3, and 2.2-4 list the mechanical systems, electrical and I&C systems, and structures, respectively, that are within the scope of license renewal for Fermi 2. 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 reference to the UFSAR 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 2.2-5 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 UFSAR that describes the system or structure. For structures with no UFSAR reference, a brief description of the building function is given. None of these structures house safety-related equipment nor are they situated such that a failure of the structure would impact a safety function.

The list of systems used in these tables and determination of system boundaries is based on the Fermi 2 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. As needed, system components are grouped functionally for the aging management review. For example, ASME Class 1 components in various systems are evaluated with the ASME Class 1 reactor coolant pressure boundary in Section 2.3.1.2, and containment penetrations from various systems are grouped into one containment penetrations review in Section 2.3.2.6. For each system, the discussion under "Components Subject to Aging Management Review" provides 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 by system in the (a)(2) aging management reviews (AMRs). The (a)(2) AMRs include nonsafety-related components with the potential for spatial interaction with safety-related components 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) system reviews are presented at the end of the mechanical system sections: Section 2.3.1.7, Miscellaneous Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2); Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2); Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2); and Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2).

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.

The list of plant structures was developed from a review of the UFSAR, plant layout drawings, Fire Hazard Analysis (Appendix 9A.4 of the UFSAR), design basis documents, and Maintenance Rule Basis documents. Structure intended functions are identified in the section referenced in Table 2.2-4. Structural commodities associated with mechanical systems, such as pipe hangers and insulation, are evaluated with the structural bulk commodities.

Because of the bounding approach used for scoping electrical and I&C equipment, all plant electrical and I&C 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. For further information on electrical and I&C systems, see Section 2.5, Scoping and Screening Results: Electrical and Instrumentation and Control Systems.

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

System Code	System Name	LRA Section Describing System
B11	Reactor Assembly	Section 2.3.1.1, Reactor Assembly
B21	Nuclear Boiler	Section 2.3.1.3, Nuclear Boiler
B31	Reactor Recirculation	Section 2.3.1.4, Reactor Recirculation
C11	Control Rod Drive Hydraulic Control	Section 2.3.3.1, Control Rod Drive
C32	Feedwater Control	Section 2.3.4.2, Feedwater and Standby Feedwater
C36	Dedicated Shutdown	Section 2.3.3.11, Heating, Ventilation and Air Conditioning
C41	Standby Liquid Control	Section 2.3.3.2, Standby Liquid Control
C51	Neutron Monitoring	Section 2.3.1.5, Neutron Monitoring
C71	Reactor Protection	Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection
D11	Process Radiation Monitoring	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
E11, E61	Residual Heat Removal	Section 2.3.2.2, Residual Heat Removal Section 2.3.3.3, Service Water
E21	Core Spray	Section 2.3.2.3, Core Spray
E41	High Pressure Coolant Injection	Section 2.3.2.4, High Pressure Coolant Injection
E51	Reactor Core Isolation Cooling	Section 2.3.2.5, Reactor Core Isolation Cooling
F11, F12, F13, F14, F15, F16, F17, F19	Service and Handling Equipment	Section 2.3.3.4, Fuel Pool Cooling and Cleanup
G11	Radioactive Waste	Section 2.3.3.14, Plant Drains
G33	Reactor Water Cleanup	Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection
G41	Fuel Pool Cooling and Cleanup	Section 2.3.3.4, Fuel Pool Cooling and Cleanup

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

System Code	System Name	LRA Section Describing System
G51	Torus Water Management	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
H21	Local Panels and Racks	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
J11	Fuel and Reloads	Section 2.3.1.6, Fuel and Reloads
N11	Main and Reheat Steam	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N20	Condensate	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N21	Feedwater and Standby Feedwater	Section 2.3.4.2, Feedwater and Standby Feedwater
N22	Heater Drains	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N30	Main Turbine Generator and Auxiliaries	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N61	Condenser and Auxiliaries	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N62	Off-Gas Process and Vacuum	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
N71	Circulating Water	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
P11	Condensate Storage and Transfer	Section 2.3.4.1, Condensate Storage and Transfer
P21	Potable Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

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

System Code	System Name	LRA Section Describing System
P27	General Service Water (GSW) Biocide Injection	Section 2.3.3.7, Fire Protection – Water
P33	Process Sampling	Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection
P34	Post-Accident Sampling	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P41	General Service Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P42	Reactor Building Closed Cooling Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P43	Turbine Building Closed Cooling Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P44	Emergency Equipment Cooling Water	Section 2.3.3.5, Emergency Equipment Cooling Water
P45	Emergency Equipment Service Water	Section 2.3.3.3, Service Water
P46	Supplemental Cooling Chilled Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P50	Station Air, Control Air, Emergency Breathing Air	Section 2.3.3.6, Compressed Air
P61	Auxiliary Boiler	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P70	Waste Oil	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P79	On-Line Noble Chemistry Injection	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P80, T80, U80, V80, X80	Fire Protection	Section 2.3.3.7, Fire Protection – Water Section 2.3.3.8, Fire Protection – Carbon Dioxide and Halon
P85	Zinc Injection	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

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

System Code	System Name	LRA Section Describing System
P95	Drips, Drains and Vents	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
R11	Auxiliary Electrical Peaker Combustion Turbine Generator	Section 2.3.3.9, Combustion Turbine Generator
R30	Emergency Diesel Generators	Section 2.3.3.10, Emergency Diesel Generator
T21, T22	Reactor/Auxiliary Building	Section 2.3.3.6, Compressed Air
T23	Primary Containment	Section 2.3.2.6, Containment Penetrations
T25	Storage Pools	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
T41	Reactor/Auxiliary Building Heating, Ventilation and Air Conditioning (HVAC)	Section 2.3.3.11, Heating, Ventilation and Air Conditioning
T45	Floor and Equipment Drains	Section 2.3.3.14, Plant Drains
T46	Standby Gas Treatment	Section 2.3.2.7, Standby Gas Treatment
T47	Primary Containment Atmosphere Cooling	Section 2.3.3.11, Heating, Ventilation and Air Conditioning
T48	Containment Atmospheric Control	Section 2.3.3.13, Containment Atmospheric Control
T49	Primary Containment Pneumatics	Section 2.3.3.6, Compressed Air
T50	Primary Containment Monitoring	Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection
U41	Turbine Building HVAC	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
U42	Turbine Building Potable Water and Plumbing	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

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

System Code	System Name	LRA Section Describing System
X41	RHR Complex and Office Service Building (OSB) HVAC	Section 2.3.3.11, Heating, Ventilation and Air Conditioning
X42	RHR Complex Drains and OSB Potable Water	Section 2.3.3.14, Plant Drains

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

System Code	System Name	UFSAR Reference
A35	Cleaning and Decontamination	Sections 9A.4.1.8.1 and 9A.4.5.1
A70	Security Plan and System	None
G13	Independent Spent Fuel Storage Installation	Section 11.8
P12	Condensate Makeup (or Demineralized Water Makeup)	Section 9.2.3
P73	Hydrogen Water Chemistry	Section 10.4.10
P90	Chemical Injection	None
S12	Generator Isolated Phase Bus	None
S31	345KV Relay House	Section 8.2.1.2
T31	RB Cranes, Hoists and Elevators	Section 9.1.4
V21	Radwaste Building Potable Water	Section 9.2.4
V41	Radwaste Building (RWB) and On-Site Storage Facility (OSSF) HVAC	Section 9.4.3
V45	RWB Drains	Section 9.3.3
V81	Radwaste Building Equipment	None
W21	Circulating Water Pumphouse Substructure	Section 9.2.4
W23	Circulating Water Dehalogenation	Section 10.4.5.2
W24, W25	Circulating Water Natural Draft Cooling Tower and Cooling Tower Reservoir	Sections 1.2.2, 2.4.8.2 and 10.4.5.2
W27	Circulating Water Biocide Injection	Section 10.4.5.2
W41	Circulating Water Pumphouse Heating and Ventilation	Section 9.4.10
Y41	Storm Sewer	Section 2.4.2.2.5
Y44	Sanitary Sewage Treatment	Section 1.2.1.3.5.2
Y45	Condensate Storage Tank Sump Pumps	Section 9.2.6.2
Y52	Chemical and Oil Storage and Transfer	Sections 9.5.4.2 and 9A.4.7.3

Table 2.2-2 (Continued)
Mechanical Systems Not Within the Scope of License Renewal

System Code	System Name	UFSAR Reference
Y80	CTG Fire Protection	Section 9A.4.7.9
Z41	Technical Support Center (TSC) and Office Building Annex (OBA) HVAC	Sections 7.8 and 9A.4.9
Z51	Nuclear Operations Center (NOC) and TSC Miscellaneous Equipment	Section 7.8

Table 2.2-3
Plant Electrical and I&C Systems Within the Scope of License Renewal

System Code	System Name	UFSAR Reference
A71	Primary Containment Isolation	UFSAR Section 6.2.4
C35	Remote Shutdown	UFSAR Section 7.5.1.5.2
C93	Simulator	None
C96	Integrated Plant Computer	UFSAR Section 7.6.1.9.1.1
C97	Annunciator/Sequence of Events	UFSAR Section 7.6.1.11
D21	Area Radiation Monitoring	UFSAR Section 12.1.4
D30	Seismic Monitoring	UFSAR Section 3.7.4*
D40	Meteorological Monitoring	UFSAR Section 2.3.3.2
E10	Leakage Detection	UFSAR Sections 6.3.2.2.7 and 7.6.1.8.12
H11	Control and Auxiliary Room Panels	UFSAR Section 7.5*
H40	Communications	UFSAR Section 9.5.2
P82	Fire Detection	UFSAR Sections 9.5.1.2 and 9A.2.3.5.1
R12	System Service Transformer	UFSAR Section 8.2*
R14	Switchgear	UFSAR Sections 8.2 and 8.3*
R15	Grounding	UFSAR Section 8.3.1.1.12.1
R16	Motor Control Centers and Distribution Cabling	UFSAR Section 8.3*
R17	120V AC Power Supply and Distribution Cabinets	UFSAR Section 8.3.1*
R21	Station Blackout Electrical	UFSAR Section 8.4*
R31	Vital Power	UFSAR Section 8.3*
R32	DC Power	UFSAR Section 8.3.2
R33	Plant Welding	None
R34	Plant Wire / Cable	None
R35	Raceways / Fittings	None
R36	Lighting	UFSAR Section 9.3.5

Table 2.2-3 (Continued)
Plant Electrical and I&C Systems Within the Scope of License Renewal

System Code	System Name	UFSAR Reference
R37	Engineers Test Transformer	None
S11	Generator Transformer	UFSAR Section 8.2*
S13	Generator Metering and Synchronizing	None
S14	Telemetering EF1-EF2 120 and 13.8 KV Controls	None
S15	345 KV Line Instrumentation	UFSAR Section 8.2*
S20	345 KV Switchyard	UFSAR Section 8.2.1.2
S31	345KV Relay House	UFSAR Section 8.2.1.2
S40	120 KV Switchyard	UFSAR Section 8.2.1.2
T51	Reactor/Auxiliary Building Lighting, Communications and Other Electrical Service	UFSAR Sections 8.3, 9.5.2, and 9.5.3*
T82	Reactor/Auxiliary Building Fire Detection	UFSAR Section 9.5.1.2*
U51	Turbine Building Lighting, Communications and Other Electrical Service	UFSAR Sections 8.3, 9.5.2, and 9.5.3*
U82	Turbine Building Fire Detection	UFSAR Section 9.5.1.2*
V51	Radwaste Building Lighting, Communications and Other Electrical Service	UFSAR Sections 8.3, 9.5.2, and 9.5.3*
V82	Radwaste Building Fire Detection	UFSAR Section 9.5.1.2*
W51	Circulating Water Pump House Lighting, Communications and Other Electrical Service	UFSAR Sections 8.3, 9.5.2, and 9.5.3*
W82	Circulating Water Pump House Fire Detection	UFSAR Section 9.5.1.2*
X82	Fire Detection (Other Buildings)	UFSAR Section 9.5.1.2*
Y46	Yard Cathodic Protection	UFSAR Sections 9.2.6, 9.5.1*

*System is not discussed as a stand-alone system.

Table 2.2-4
Structures Within the Scope of License Renewal

Structure Name	LRA Section
Combustion Turbine Generator (CTG) No. 11-1 Unit	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Condensate Storage and Return Tank Foundations and Retaining Barrier	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Cranes, Trolleys, Monorails and Hoists	Reviewed with the building in which each is housed.
CTG-11 Fuel Oil Storage Tank Foundation	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
General Service Water Pump House	Section 2.4.2, Water-Control Structures
Independent Spent Fuel Storage Installation (ISFSI) Rail Transfer Pad	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Manholes, Handholes and Duct Banks	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Primary Containment Structure	Section 2.4.1, Reactor/Auxiliary Building and Primary Containment
Radioactive Waste Building	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Reactor Building/Auxiliary Building	Section 2.4.1, Reactor/Auxiliary Building and Primary Containment
Relay House, 120kV Switchyard	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Relay House, 345kV Switchyard	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Residual Heat Removal (RHR) Complex	Section 2.4.2, Water-Control Structures
Shore Barrier	Section 2.4.2, Water-Control Structures
Transformer/Switchyard Support Structures and Foundations	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
Turbine Building	Section 2.4.3, Turbine Building, Process Facilities and Yard Structures

Table 2.2-5
Structures Not Within the Scope of License Renewal

Structure Name	UFSAR Reference or Structure Function
Auxiliary Boiler House	Section 9A.4.7.4
Auxiliary Boiler Fuel-Oil Storage Tank Foundation	Section 9A.4.7.3
Availability Improvement Building	Provides office and maintenance space for station personnel.
Circulating Water Pump House	Section 10.4.5.2
Circulating Water Reservoir	Section 2.4.8.2 and 10.4.5.2
Combustion Turbine Generator (CTG) No. 11-2, -3 and -4 Units	Section 7.5.2.5.2 and 8.2.1.2
Cooling Towers	Section 10.4.5.2
Cooling Water Intake Channel and Jetty	Section 2.2.3.1
Demineralized Water Storage Tank Foundation	Section 9.2.3.2
Fermi 1 structures	Support Fermi 2 by providing laboratory space, office and storage space, and support equipment for the potable water system and sewer system. The sanitary sewer system (Y44) is not within the scope of license renewal, and the potable water system (P21) has no components subject to aging management review in Fermi 1 structures since the system's only intended function for license renewal meets the criterion of 10 CFR 54.4(a)(2).
Hydrogen Storage Facility	Section 9A.4.7.6
Hydrogen Water Chemistry (HWC) Gas Supply Facility	Section 9A.4.7.8
ISFSI Equipment Storage Building	Section 9A.4.12
ISFSI Fabrication Pad	Provides an area for construction of dry cask containers.
ISFSI Storage Pad	Section 9.1.2.2.3
Maintenance Oil Storage Building	Provides working space for maintenance personnel and storage area.

Table 2.2-5 (Continued)
Structures Not Within the Scope of License Renewal

Structure Name	UFSAR Reference or Structure Function
Neutralization Tank Foundation	Provided support for the underground neutralization tank. The neutralization tank (also known as regenerant wastes neutralization tank) has been abandoned.
Nitrogen Inerting System Prefab Building	Houses nitrogen inerting equipment in support of containment atmosphere.
Oil/Water Separator Structure	Provides a holding area for oil contaminated liquids.
Office-Service Building	Section 9A.4.6
Office Building Annex and Technical Support Center	Section 7.8.2.4 and 9A.4.9
Onsite Storage Facility	Section 11.7
Outage Building	Section 9A.4.1.1
Pipe Fabrication Shop (Bldg 45)	Provides storage space and personnel work area for equipment maintenance.
Personnel Access Portal Building	Provides site access to the plant protected area and provides some office space for security personnel and equipment.
Security Building	Provides office space for security personnel.
Storage Building (Building 24)	Provides additional equipment storage space.
Vehicle Inspection Building (VIB)	Provides an area for inspection of vehicles prior to entry into the plant secure area.
Warehouse (Buildings 41,42, 43, 49)	Provides space for storage of materials and some work space for personnel.
Warehouse B (Building 19)	Provides work space for site personnel.

2.3 SCOPING AND SCREENING RESULTS: MECHANICAL SYSTEMS

2.3.1 Reactor Coolant System

The following systems are described in this section.

- Section 2.3.1.1, Reactor Assembly
  - Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances
  - Section 2.3.1.1.2, Reactor Vessel Internals
- Section 2.3.1.2, Reactor Coolant Pressure Boundary
- Section 2.3.1.3, Nuclear Boiler
- Section 2.3.1.4, Reactor Recirculation
- Section 2.3.1.5, Neutron Monitoring
- Section 2.3.1.6, Fuel and Reloads
- Section 2.3.1.7, Miscellaneous Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2)

2.3.1.1 Reactor Assembly

System Description

The reactor assembly system (system code B11) consists of the reactor pressure vessel (RPV) and appurtenances, including RPV internals components such as the core, shroud, steam separator and dryer assemblies, and jet pumps. Also included in the reactor assembly are the control rods and control rod drive (CRD) housings. (The CRD mechanisms are in system code C11; see Section 2.3.3.1.)

RPV and Appurtenances

The purpose of the RPV 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 RPV provides a volume in which the core can be submerged in coolant. The RPV and appurtenances includes the vessel shell, top and bottom heads, nozzles and penetrations, internal and external attachments, and vessel supports.

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

The RPV flanges are sealed with two concentric metal seal rings. To detect seal failure, a vent tap is located between the two seal rings. A monitor line is attached to the tap to provide an indication of leakage from the inner seal ring.

Vessel nozzles connect the reactor vessel to various systems and components, including reactor recirculation, main steam, feedwater, core spray, standby liquid control (which shares a nozzle with the differential pressure instrumentation), control rod drives, jet pump instrumentation, vents, and other instrumentation.

There are multiple attachments to the reactor pressure vessel for supporting various internal components. The internal attachments include brackets for guide rods, steam dryer support, core spray, feedwater sparger, jet pumps, surveillance specimen holder, shroud support, and dryer hold-down.

There are multiple external attachments to the reactor pressure vessel. The external attachments include stabilizer brackets and thermocouple pads.

The RPV stabilizers are designed to permit radial and axial vessel expansion, to limit horizontal vibration, and to resist seismic and jet reaction forces. The stabilizers are connected between the RPV and the top of the shield wall surrounding the RPV to provide lateral stability for the upper part of the RPV. Eight stabilizer brackets are attached by full-penetration welds to the RPV at evenly spaced locations around the RPV below the flange.

The RPV support assembly consists of a ring girder, sole plates, and the various bolts, shims, and set screws necessary to position and secure the assembly between the RPV support skirt and the support pedestal. The concrete and steel support pedestal is constructed integrally with the building foundation. Steel anchor bolts are set in the concrete with the threads extending above the surface. The sole plates are bolted to the underside of the RPV ring girder. The sole plate-ring girder assembly is set, leveled, and grouted to the top of the RPV pedestal.

The CRD housings are inserted through the CRD penetrations in the RPV bottom head and are welded to stub tubes extending into the RPV. Each housing transmits a number of loads to the bottom head of the reactor, including the weights of a control rod, a CRD, a control rod guide tube, a four-lobed fuel support piece, and the four fuel assemblies that rest on the fuel support piece.

Each in-core neutron flux monitor housing is inserted through the in-core penetrations in the bottom head of the RPV and is welded to the inner surface of the bottom head. An in-core flux monitor guide tube is welded to the top of each housing. Either a source range monitor/ intermediate range monitor (SRM/IRM) drive unit or a local power range monitor (LPRM) is bolted to the seal-ring flange at the bottom of the housing.

The refueling bellows forms a seal between the RPV and the surrounding primary containment drywell to permit flooding of the space (reactor well) above the RPV during refueling operations. The refueling bellows assembly consists of a bellows, a backing plate, a spring seal, and a removable guard ring.

See Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances, for further discussion.

RPV Internals

The purpose of the RPV internals is to provide a continuous internal circulation path for the core coolant flow, direct the flow of coolant water from various sources, separate moisture from the steam leaving the vessel, sense the differential pressure across the core support plate, and locate laterally and support the fuel assemblies, control rod guide tubes, and steam separators.

The core support structures and RPV internals include the following components.

Core Support Structures

- Control rod guide tubes
- Core support and hold-down bolts
- Fuel supports

- Shroud
- Shroud support assembly and access hole cover
- Top guide (including wedges, bolts, and keepers)

The core support structures form partitions within the RPV and sustain pressure differentials across the partitions.

The shroud is a cylindrical, stainless steel structure that surrounds the core and provides a barrier to separate the upward flow through the core from the downward flow in the annulus. The shroud also provides a floodable volume in the unlikely event of an incident that tends to drain the RPV. The floodable inner volume of the RPV is the volume inside the core shroud up to the level of the jet pump suction inlet.

Reactor Pressure Vessel Internals

- Control rods
- Core spray lines and spargers.
- Differential pressure and standby liquid control line
- Feedwater spargers
- Fuel
- Guide rods for shroud head and steam dryer
- In-core flux monitor guide tubes and stabilizers
- Jet pump assemblies and instrumentation
- Shroud head and steam separator assembly (including shroud head bolts)
- Steam dryers
- Surveillance sample holders

The control rods perform dual functions of power distribution shaping and reactivity control. Because the control rods and the fuel assemblies are periodically replaced, they are not subject to aging management review.

See Section 2.3.1.1.2, Reactor Vessel Internals, for further discussion.

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

- Provide structural integrity for reactor vessel internals.
- Provide a volume in which the core can be submerged in coolant.
- Provide a floodable inner volume following a LOCA.
- Provide a barrier to the release of radioactive materials.
- Maintain reactor coolant pressure boundary (RCPB).

- Maintain reactor core geometry.
  - Provide a floodable volume in which the core can be adequately cooled in the event of a breach in the RCPB external to the reactor vessel.
  - Provide correct coolant distribution.

The reactor assembly 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 (steam dryer assembly).

The reactor assembly system has no intended function for 10 CFR 54.4(a)(3).

UFSAR References

Section 1.2.2.5.2	Section 5.1
Section 4.1	Section 5.2.1.1.1
Section 4.1.2.2	Section 5.4.6.3
Section 4.1.3.1	Figure 4.1-1
Section 4.5.1.2	Table 5.4-1

Components Subject to Aging Management Review

The reactor assembly system is reviewed as the following subsystems.

- Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances
- Section 2.3.1.1.2, Reactor Vessel Internals

License Renewal Drawings

License renewal drawings are not provided for the reactor vessel and the reactor vessel internals. See Section 2.3.1.2, Reactor Coolant Pressure Boundary, for license renewal drawings associated with the RCPB.

2.3.1.1.1 Reactor Pressure Vessel and Appurtenances

Description of Components Subject to Aging Management Review

For this aging management review, the RPV includes the following major subcomponents: shell, bottom head, top head, flanges, studs, nuts, bushings, nozzles, caps, welds, and safe ends. The vessel boundaries considered in this review are typically the weld between the safe end extensions and attached piping or at the interface flange for bolted connections. Thermal sleeve extensions that are welded to vessel nozzles or safe ends, thermal sleeves, CRD housings, in-core housings, bolting, vessel support skirt, vessel interior welded attachments, and vessel external attachments are evaluated in this review.

The RPV and its appurtenances constitute a fission product barrier and provide support to withstand adverse combinations of loading and forces resulting from normal, abnormal, and emergency conditions. In addition to a fission product barrier, the vessel is part of the reactor coolant system pressure boundary. RPV subcomponents provide structural support to safety-related equipment.

Reactor vessel intended functions for license renewal are included in the reactor vessel assembly intended functions in Section 2.3.1, Reactor Coolant System.

Table 2.3.1-1 lists the component types that require aging management review.

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

UFSAR References

Section 3.1

Section 5.2

Section 5.4

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

Component Type	Intended Function
Attachments and Supports and Welds	
Reactor vessel external attachments • Support skirt • Stabilizer brackets	Structural support
Reactor vessel internal attachments • Steam dryer hold down lug • Guide rod brackets • Steam dryer support lugs • Core spray brackets • Feedwater sparger brackets • Surveillance specimen brackets • Jet pump riser support pads and pad to riser brace welds	Structural support
Welds • Guide rod brackets to vessel • Steam dryer support lugs to vessel • Core spray brackets to vessel • Feedwater sparger brackets to vessel • Surveillance specimen brackets to vessel	Structural support
Bolting	
In-core housing bolting, CRD flange bolting, Upper head nozzle flange bolting	Pressure boundary
Reactor vessel closure flange bolting • Closure studs, nuts, washers and bushings	Pressure boundary
Nozzles and Penetrations and Welds	
CRD housings	Pressure boundary
Penetrations In-core housings	Pressure boundary

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

Component Type	Intended Function
Penetrations • Core differential pressure/standby liquid control (SLC) nozzle • CRD stub tubes	Pressure boundary
Nozzles • Recirc outlet (N1) • Recirc inlet (N2) • Steam (N3) • Core spray (N5) • Spare Instrumentation (N6) • Vent (N7) • Jet pump instrument (N8) • CRD hydraulic system return (N9) • Instrumentation (N11, N12) • Seal leak detection (N13) • Instrumentation (N16) • Drain (N15) • Feedwater (N4)	Pressure boundary
Welds (nozzle to vessel) • Instrumentation (N11, N12, N16)	Pressure boundary
Safe Ends, Thermal Sleeves, Flanges, Caps, and Welds	
CRD return line cap (N9)	Pressure boundary
Nozzle flanges • Vent (N7) • Spare instrumentation (N6) including blind flanges	Pressure boundary
Nozzle safe ends $\geq$ 4 inches • Recirculation outlets (N1) • Recirculation inlets (N2) • Jet pump instrumentation (N8) • Core spray (N5)	Pressure boundary
Nozzle safe ends and extensions $\geq$ 4 inches • Steam (N3) • Core spray (N5)	Pressure boundary

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

Component Type	Intended Function
Nozzle safe ends ≥ 4 inches • Feedwater (N4)	Pressure boundary
Nozzle safe ends < 4 inches • Core differential pressure (N10)	Pressure boundary
Thermal sleeves ≥ 4 inches • Recirculation inlets (N2) • Core spray (N5)	Pressure boundary
Welds (nozzle to safe end) • Recirculation outlet (N1) • Recirculation inlet (N2) • Jet pump instrumentation (N8)	Pressure boundary
Shell and Heads	
Reactor pressure vessel • Top head • Top head/closure flange • Non-beltline shell rings/closure flange • Bottom head • Beltline shell rings and connecting welds	Pressure boundary

2.3.1.1.2 Reactor Vessel Internals

Description of Components Subject to Aging Management Review

The evaluation boundaries for the aging management review include the components identified in Section 2.3.1.1 under the heading, RPV Internals. The following discussion provides descriptions and identifies components that are subject to aging management review.

Control Rod Guide Tubes

The control rod guide tubes, located inside the RPV, extend from the top of the CRD housing up through holes in the core support plate. Each tube is designed as the guide for the control rod and as the vertical support for a four-lobed orificed fuel support piece and the four fuel assemblies surrounding the control rod.

The control rod guide tubes (CRGTs) support the fuel and control rods and as such are subject to aging management review. The CRD thermal sleeves lock the CRGTs into position and are also subject to aging management review. The CRGTs and control rod drive thermal sleeves are included in this review.

CRD housings are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances. The Class 1 CRD mechanisms are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary and the remainder of the CRD hydraulic system is reviewed in Section 2.3.3.1, Control Rod Drive.

Core Spray Lines and Spargers

The core spray lines are the means for directing flow to the core spray spargers that distribute coolant so that peak fuel cladding temperatures of 2200°F are not exceeded during accident conditions. Two core spray lines enter the RPV through the two core spray nozzles. The lines divide immediately inside the RPV and are routed to opposite sides of the RPV wall. From there, the lines are routed downward into the downcomer annulus and pass through the upper shroud immediately below the flange. The flow divides again as it enters the center of the sparger, which is routed around the inside of the upper shroud.

The core spray lines and nozzles function to distribute flow across the core as part of the emergency core cooling system (ECCS) and are subject to aging management review.

Core spray lines and spargers inside the vessel are included in this review. The RPV nozzle, thermal sleeve, and brackets attached to the vessel wall associated with core spray are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances.

The remaining Class 1 components of the core spray system are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

Core Support Plate Assembly

The core support plate assembly consists of a circular plate with bored holes stiffened with a rim and beam structure. The plate provides lateral support and guidance for the control rod guide tubes, incore flux monitoring guide tubes, and peripheral fuel supports. The peripheral fuel supports are also supported vertically by the core support plate.

The core plate assembly is subject to aging management review since it provides lateral support for the fuel bundles, control rod guide tubes, and in-core instrumentation during seismic events and provides vertical support for the peripheral fuel assemblies. The core plate assembly, including the core plate and rim hold-down bolts, is included in this review.

Differential Pressure (ΔP) and Standby Liquid Control (SLC) Line

The differential pressure and SLC line serves two functions: to sense the differential pressure across the core support plate and to provide a path for the injection of the liquid control solution into the coolant stream. The instrumentation lines provide information on core flow performance for diagnostic purposes, CRD system water differential pressure indication, and core spray piping break detection. This line enters the RPV at a point below the core shroud as two concentric pipes. In the lower plenum, the two pipes separate. If the standby liquid control system actuates, the inner pipe reduces thermal shock to the RPV nozzle. The outer pipe terminates immediately above the core support plate and senses the pressure in the region outside the fuel assemblies.

A complete loss of integrity at any location along the ΔP/SLC injection pipe during operation will result in a reduction in core plate differential pressure indication that is detectable in the control room. Failure of this line will not have an adverse impact on achieving safe shutdown. In the BWR Vessel and Internals Project document BWRVIP-06 safety assessment, there are several components where extensive degradation can be tolerated because of the redundancy provided in the SLC system. A number of these failures are readily detected, but even without detection of cracking, the SLC system would perform its function adequately when initiated as long as the sodium pentaborate is injected into the bottom head. This conclusion is based on the most conservative scenario, following the Emergency Procedure Guidelines for Anticipated Transient Without SCRAM (ATWS), where water level in the vessel is lowered initially to decrease power level and then increased to establish natural circulation which carries the boron into the core. The injection of sodium pentaborate is also credited for post-LOCA control of suppression pool pH. However, this function is similarly dependent only on injection of the sodium pentaborate into the vessel and then into the suppression pool via the break. Therefore, the ΔP/SLC lines inside the reactor vessel have no license renewal intended function and are not subject to aging management review.

The ΔP/SLC lines outside the vessel do have a safety function and are subject to aging management review. The RPV nozzle associated with the differential pressure and standby liquid control line is reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances. The remaining Class 1 components associated with ΔP/SLC lines are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

Feedwater Spargers

The feedwater spargers are perforated headers located in the mixing plenum above the downcomer annulus. A sparger is fitted to each feedwater nozzle and is shaped to conform to the curve of the RPV wall. Feedwater flow enters the center of the spargers and is discharged out the top of the sparger through nozzles directed radially inward to mix the cooler feedwater with the downcomer flow from the steam separators before it contacts the RPV wall. The feedwater also serves to condense the steam in the region above the downcomer annulus and to subcool the water flowing to the jet pumps and recirculation pumps.

The feedwater spargers inside the reactor vessel do not perform any safety function. BWRVIP-06-A (Section 3.3) reviewed the failure consequences of this subcomponent and determined that disengagement of a feedwater sparger from the inlet nozzle could result in jet impingement on the steam separators, but there would be no safety-related subcomponents in the path of the jet. A loose feedwater sparger also may drop on core spray piping or lodge in the annulus after impacting jet pumps. Failure of a feedwater sparger would be detectable due to changes in feedwater flow balance.

Further, BWRVIP-06-A (Section 4.2) concludes that there is no significant safety concern from potential loose parts on fuel. There also is no safety concern for interference with main steam isolation valves (MSIVs) or control rod operation; damage to reactor internals; corrosion or chemical reaction with other reactor materials; or interference with reactor core isolation cooling (RCIC) operation, reactor water cleanup (RWCU) or residual heat removal (RHR) isolation valves, nuclear instrumentation, or RHR pumps or heat exchangers. There could be some possible operating concerns from the potential loose parts with regard to fuel fretting, bottom head drain plugging, and recirculation system performance, but none of these would negatively affect safe shutdown or increase offsite dose. Consequently this subcomponent has no license renewal intended function and is not subject to aging management review.

The RPV nozzles, thermal sleeves, and brackets welded to the vessel and associated with the feedwater are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances. The remaining Class 1 components of the feedwater system are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

Fuel Supports

The fuel supports are two basic types: peripheral supports and four-lobed fuel supports. The peripheral fuel supports are located at the outer edge of the active core, not adjacent to control rods. Each peripheral fuel support supports one fuel assembly and contains a single orifice assembly designed to ensure proper coolant flow to the fuel peripheral assembly. Each four-lobed orificed fuel support supports four fuel assemblies and is provided with orifice plates to ensure proper coolant flow distribution to each rod-controlled fuel assembly.

The orificed fuel supports provide lateral support, vertical support, and alignment of the fuel bundles. In addition, they distribute core flow into the fuel bundles. Orificed fuel supports are subject to aging management review and are included in this review.

Guide Rods

The shroud head, and steam separators and dryers are guided into position with two guide rods and locating pins. The guide rods are used for alignment of the shroud head and steam dryer during assembly and disassembly of reactor vessel internals.

The guide rods serve no safety function. In the unlikely event the guide rods were to come apart during operation, large pieces would likely become lodged on top of the shroud support in the annulus region. BWRVIP-06-A (Section 3.2.1) reviewed failure consequences of loose parts similar to the guide rods and concluded these loose parts are unlikely to create an unsafe condition. Specifically, failure of a guide rod or its support brackets could result in a loose part that would be transported into the shroud annulus. Damage to jet pump sensing lines is possible as a result of a loose guide rod. However, failure of a jet pump sensing line is detectable, and the components are not safety-related. Based on the possibility that loose parts from the guide rods could affect the safety-related components such as the MSIVs, the guide rods are subject to aging management review as a nonsafety-related component whose failure could prevent satisfactory accomplishment of the safety function of other structures, systems and components.

The guide rod attachment brackets are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances.

In-Core Flux Monitor Guide Tubes

The incore flux monitor guide tubes provide a means of positioning fixed detectors in the core as well as provide for calibration monitors (traversing in-core probe [TIP] system). The guide tubes extend from the top of the in-core flux monitor housing in the lower plenum to the top of the core plate. The power range detectors for the LPRM units and the dry tubes for the SRM/IRM detectors are inserted through the guide tubes.

The in-core flux monitoring guide tubes provide the path for and support of neutron monitoring instruments (SRM, IRM and LPRM) and are subject to aging management review. The dry tubes for SRM/IRM detectors, inserted into the flux monitoring guide tubes, are inside the reactor vessel and part of the RCPB. The dry tubes are subject to aging management review. In-core flux monitoring guide tubes and dry tubes are included in this review.

The in-core housings, as attachments welded to the reactor vessel wall, are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances.

Jet Pump Assembly

The jet pump assemblies are located in two semicircular groups in the downcomer annulus between the core shroud and the reactor pressure vessel wall. Each stainless steel jet pump consists of driving nozzles, suction inlet, mixer section (which is sometimes referred to as the throat or barrel section), and diffuser. The driving nozzle, suction inlet, and mixing section are joined together as a removable unit, and the diffuser is permanently installed. High pressure water from the recirculation pumps is supplied to each pair of jet pumps through a riser pipe welded to the recirculation inlet nozzle thermal sleeve. A riser brace consists of cantilever beams extending from pads on the RPV wall.

The jet pump assemblies form part of the floodable volume around the core. The jet pump assemblies are subject to aging management review and are included in this review. The recirculation nozzles, safe ends, and thermal sleeves are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances. The remaining Class 1 recirculation system components outside the reactor vessel are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

Jet Pump Instrumentation

Jet pump instrumentation provides indication of jet pump integrity and core flow measurement. While this instrumentation is required for operation, it is not required for safe shutdown (when jet pumps are not operating) nor would a core flow sensing line failure cause a failure of other internals components. Therefore, jet pump instrumentation inside the vessel has no license renewal intended function and is not subject to aging management review.

The jet pump instrumentation RPV nozzles are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances. The jet pump sensing lines outside the reactor vessel are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

Shroud

The shroud is a cylindrical assembly that provides a partition to separate the upward flow of coolant through the core from the downward recirculation flow. This partition separates the core region from the downcomer annulus, thus providing a floodable region following a recirculation line break.

The volume enclosed by the shroud is characterized by three regions. The upper shroud surrounds the core discharge plenum, which is bounded by the shroud head on top and the top guide below. The central portion of the shroud surrounds the active fuel and forms longest section of the shroud. This section is bounded at the bottom by the core support plate. The lower shroud support cylinder, surrounding part of the lower plenum, is welded to the RPV shroud support assembly.

The shroud directs coolant flow through the core and forms part of the boundary that maintains coolant level floodable volume in the event of a LOCA. It also provides vertical and lateral support for the shroud head/steam separator, core plate, and top guide, and supports the core spray spargers. All sections of the shroud are subject to aging management review and are included in this review.

Shroud Head and Steam Separator Assembly

The shroud head and steam separator assembly is bolted to the top of the shroud to form the top of the core discharge plenum. This plenum provides a mixing chamber for the steam-water mixture before it enters the steam separators. Individual stainless steel axial flow steam separators are attached to the top of standpipes that are welded into the shroud head. The steam separators have no moving parts. In each separator, the steam-water mixture rising through the standpipe passes vanes that impart a spin to establish a vortex separating the water from the steam. The separated water flows from the lower portion of the steam separator into the downcomer annulus.

The shroud head and steam separator assembly, including hold-down bolting, do not fulfill a safety function. BWRVIP-06-A reviewed the failure consequences of these subcomponents and determined that cracking to the extent of creating a loose part was unlikely to go undetected. Further, BWRVIP-06-A (Section 4.2) concluded that even if loose parts were generated, there is no significant safety concern from those postulated loose parts.

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. The conclusion of BWRVIP-06-A therefore remains valid for the steam separators even considering recent operating experience. Consequently, this subcomponent has no license renewal intended function and is not subject to aging management review.

Shroud Support Assembly and Access Hole Covers

The shroud support assembly consists of a circular plate with gussets welded to the RPV wall. This support is designed to carry the weight of the shroud, shroud head, core support plate, top guide, steam separators, jet pump assembly, and to laterally support the fuel assemblies. Design of the shroud support also accounts for pressure differentials across the shroud plate, for the restraining effect of components attached to the support, and for earthquake and acoustic loadings.

There are two shroud support access hole covers (SSAHC) in the shroud support plate that cover holes allowing access into the lower plenum area. The SSAHCs are welded in the shroud support plate 180° apart and are part of the pressure boundary formed by the support plate.

The shroud support assembly supports the shroud and core plate while providing a floodable volume, and the assembly is subject to aging management review. The SSAHCs maintain a leak-tight barrier between the annulus and lower plenum, thus maintaining core coverage during a design basis accident, and are subject to aging management review. The shroud support assembly and SSAHCs are included in this review.

Steam Dryer

The steam dryers remove moisture from the wet steam leaving the steam separators. The extracted moisture flows down dryer vanes to collecting troughs, and then flows through tubes into drain channels and then into the downcomer annulus. The steam dryer assembly is supported by a support ring which is attached to the top of the support skirt. A skirt extends from the bottom of the dryer vane housing to the steam separator standpipe, below the water level. The skirt forms a seal between the wet steam plenum and the dry steam flowing from the top of the dryers to the steam outlet nozzles. The steam dryer support skirt is supported by pads extending from the reactor pressure vessel wall and is secured into position by the reactor pressure vessel top head.

The steam dryer does not provide any safety function. However, recent industry experience (NRC Information Notice 2013-10) has shown that cracking to the extent that generates loose parts can occur. Loose parts might interfere with the safety function of other components (e.g., MSIVs). Consequently, the steam dryer is subject to aging management review as a nonsafety-related component whose failure could prevent satisfactory accomplishment of the safety functions of other structures, systems, and components. The license renewal intended function of the steam dryer is to maintain structural integrity (i.e., not generate loose parts).

Surveillance Sample Holders

The surveillance sample holders are welded baskets containing impact and tensile specimen capsules. The baskets hang from the brackets that are attached to the inside wall of the RPV and extend to mid-height of the active core. The radial positions are chosen to expose the specimens to the same environment and maximum neutron fluxes experienced by the RPV itself while avoiding jet pump removal interference or damage.

The surveillance sample holders do not fulfill a safety function. BWRVIP-06-A (Section 3.4.2) documents that failure consequences for this type of subcomponent are not expected to create an unsafe condition. Consequently, this subcomponent has no license renewal intended function and is not subject to aging management review.

Top Guide Assembly

The top guide is formed by a series of beams joined at right angles to form square openings, with beams fastened to a peripheral rim. The top guide includes wedges, welds and bolts to position and secure the top guide beams. Each large opening provides lateral support and guidance for four fuel assemblies or, in the case of peripheral fuel, one or two fuel assemblies. Notches are provided in the bottom of the beam intersections to anchor the in-core flux monitors.

The top guide assembly, part of the core support structure, maintains alignment and spacing at the top of the fuel assemblies and provides lateral support for the upper end of installed in-core guide tubes. The top guide assembly is subject to aging management review and is included in this review.

Reactor vessel internals intended functions for license renewal are included in the reactor assembly intended functions in Section 2.3.1.1.

Table 2.3.1-2 lists the component types that require aging management review.

Table 3.1.2-2 provides the results of the aging management review.

UFSAR References

Section 4.5.1.2

Section 4.1.2

Section 5.4.6.3.2

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

Component Type	Intended Function
Control rod guide tubes • Base • Thermal sleeve • Tube	Structural support
Core support plate assembly	Structural support
Core support plate rim hold-down bolts	Structural support
Core spray lines and spargers	Flow distribution
Fuel supports • Four-lobed • Peripheral	Structural support
Fuel supports • Orifices	Flow distribution
In-core instrument flux monitoring • Guide tube	Structural support
In-core instrument flux monitoring • Dry tube	Pressure boundary
Jet pump assembly • Riser pipe • Riser elbow • Riser braces • Hold-down bolt • Mixer throat (barrel) • Restrainer bracket adjusting screws for jet pumps • Slip joint clamp body • Diffuser shell • Diffuser tail pipe • Adapter ring (upper)	Floodable volume

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

Component Type	Intended Function
Jet pump assembly • Adapter ring (lower) • Hold-down beam • Slip joint clamp adjustable bolt and ratchet lock spring • Transition piece • Suction inlet elbow • Suction inlet nozzle • Mixer adapter • Diffuser collar	Floodable volume Structural support
Jet pump assembly • Auxiliary spring wedge assemblies • Restrainer bracket wedge assembly • Restrainer bracket	Structural support
Shroud	Floodable volume Structural support
Shroud support plate and gussets	Floodable volume Structural support
Shroud support access hole cover at 180°	Floodable volume
Shroud support access hole cover at 0° • Cover and ring	Floodable volume
0° access hole adapter ring	Floodable volume
Steam dryer	Structural integrity
Top guide assembly	Structural support

2.3.1.2 Reactor Coolant Pressure Boundary

Description

This section reviews the components that are part of the reactor coolant pressure boundary (RCPB), other than the reactor vessel and its internals. UFSAR Section 5.1 defines the RCPB to include all pressure containing components such as pressure vessels, piping, pumps, and valves, that are

a. Part of the reactor coolant system, or

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

   1. The outermost containment isolation valve in system piping which penetrates primary reactor containment.

   2. The second of the two valves normally closed during normal reactor operation in system piping which does not penetrate primary reactor containment.

   3. The reactor coolant system safety/relief valves.

Systems and components within the RCPB are classified as Quality Group A. Code requirements for these components are ANSI B31.7 or ASME Section III, Class A or Class 1. These components are collectively identified as Class 1, or RCPB components, in this review.

The major components of the RCPB addressed in this review include the recirculation loop piping, pumps and valves; feedwater piping and valves; main steam piping, valves, and safety/ relief valves; and the Class 1 portions of various systems connected to the reactor vessel. These components are parts of various plant systems. The following systems, described in the referenced sections, include components in the RCPB that are addressed in this review

- Nuclear boiler (Section 2.3.1.3)
- Reactor recirculation (Section 2.3.1.4)
- Control rod drive hydraulic control (Section 2.3.3.1)
- Standby liquid control (Section 2.3.3.2)
- Residual heat removal (Section 2.3.2.2)
- Core spray (Section 2.3.2.3)
- High pressure coolant injection (HPCI) (Section 2.3.2.4)
- Reactor core isolation cooling (Section 2.3.2.5)
- Reactor water cleanup (Section 2.3.3.17)
- Feedwater and standby feedwater (Section 2.3.4.2)
- Post-accident sampling (Section 2.3.3.17)

Nuclear boiler system components (system code B21) that are part of the reactor coolant pressure boundary supply steam to the RCIC turbine and the HPCI turbine.

Components of the reactor assembly system (system code B11) that also form part of the RCPB are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances and Section 2.3.1.1.2, Reactor Vessel Internals.

This review also includes safety-related reactor coolant system components that are outside the RCPB and not addressed in other aging management reviews. This includes equipment such as recirculation pump support components and mechanical instrumentation components (piping, tubing, valves) outside the RCPB. Components of the local panels and racks system (system code H21) that form part of the reactor coolant system instrumentation system pressure boundaries are also included in this review.

Systems listed above have the following intended function for 10 CFR 54.4(a)(1).

- Maintain integrity of reactor coolant pressure boundary.

Other system intended functions are listed in the respective LRA sections referenced above.

UFSAR References

The reactor coolant pressure boundary is described in UFSAR Section 5.1 and Section 5.2. UFSAR references for the systems listed above are provided in the listed LRA section.

Components Subject to Aging Management Review

Some safety-related reactor coolant system components are included in other reviews. Air operators, air supply lines, and accumulators of the reactor coolant system are reviewed in Section 2.3.3.6, Compressed Air, and main steam safety/relief valve discharge line components are reviewed in Section 2.3.2.1, Nuclear Pressure Relief.

The majority of the components that comprise the RCPB are from the nuclear boiler system (Section 2.3.1.3) and reactor recirculation system (Section 2.3.1.4). The RCPB review also includes the Class 1 portions of various systems connected to the reactor vessel (see list above). RCPB components are reviewed as listed below.

Table 2.3.1-3 lists the component types that require aging management review.

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

License Renewal Drawings

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

System Code	System	LRA Drawings	
B21	Nuclear Boiler	LRA-M-2023 LRA-M-2089	LRA-M-2090 LRA-M-3045
B31	Reactor Recirculation	LRA-M-2833	
C11	Control Rod Drive Hydraulic Control	LRA-M-2081	
C41	Standby Liquid Control	LRA-M-2082	
E11	Residual Heat Removal	LRA-M-2083 LRA-M-2084	
E21	Core Spray	LRA-M-2034	
E41	High Pressure Coolant Injection	LRA-M-2035	
E51	Reactor Core Isolation Cooling	LRA-M-2044	
G33	Reactor Water Cleanup	LRA-M-2046	
N21	Feedwater and Standby Feedwater	LRA-M-2023	
P34	Post-Accident Sampling	LRA-I-2400-10 LRA-M-2090	

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

Component Type	Intended Function
Bolting	Pressure boundary
Condensing chamber	Pressure boundary
Flow element (HPCI and RCIC steam flow)	Flow control Pressure boundary
Flow element (main steam flow restrictors and recirculation)	Flow control
Heat exchanger (reactor recirc system pump cooler assembly)	Pressure boundary
Heat exchanger (reactor recirc system pump motor bearing oil cooling coils)	Pressure boundary
Orifice (instrument line)	Pressure boundary
Orifice (instrument line) (non-Class 1)	Pressure boundary
Piping (flange seal leak detection)	Pressure boundary
Piping (non-Class 1)	Pressure boundary
Piping < 4 inches nominal pipe size (NPS)	Pressure boundary
Piping ≥ 4 inches NPS	Pressure boundary
Pump casing and cover	Pressure boundary
Thermowell	Pressure boundary
Tubing (non-Class 1)	Pressure boundary
Valve body (flange seal leak detection)	Pressure boundary
Valve body (non-Class 1)	Pressure boundary
Valve body < 4 inches NPS	Pressure boundary
Valve body ≥ 4 inches NPS	Pressure boundary

2.3.1.3 Nuclear Boiler

System Description

The purpose of the nuclear boiler (NB) system (system code B21) is to provide the steam transport path from the reactor vessel to the second MSIV. The NB system also includes the feedwater piping from the feedwater isolation valves to the reactor vessel. The NB system is part of the RCPB and supplies steam for the HPCI and RCIC pump turbines.

The major components of the NB system consist of two trains of feedwater piping from the isolation valves to the RPV inlet nozzles, feedwater isolation valves on each feedwater loop, four main steam lines from the RPV steam outlet nozzles to the MSIVs, main steam flow elements (designed to restrict flow) located on each steam line inside the containment, two MSIVs on each main steam line, 15 safety/relief valves (SRVs) mounted on the main steam lines, SRV discharge piping, vacuum breaker valves on each SRV discharge line, and the quenching devices installed at the ends of the SRV discharge lines in the suppression pool. The NB system also includes accumulators for the MSIVs and SRVs (five SRVs that are used for automatic depressurization and two low-low set SRVs used to relieve pressure after SRV actuation).

Main Steam and Feedwater Lines

At the drywell penetrations, the incoming feedwater consists of two 20-inch lines. Each line includes two containment isolation valves. The feedwater system piping provides the coolant injection path into the RPV for HPCI (A side) and for RCIC and RWCU (B side).

Four main steam lines exit the RPV through main steam flow restrictors, one in each steam line. The function of the main steam flow restrictors is to limit the loss of coolant from the RPV to ensure the core will remain covered with water before the main steam isolation valve closure, should rupture occur in a main steam line outside the primary containment.

The main steam line flow restrictors are venturi-type flow devices. Each restrictor is a complete assembly welded into the main steam line at a point between the RPV and the first MSIV downstream of the main steam line SRVs. The assembly is self-draining in that it contains low point pockets that are drained internally to the main steam line.

Drains from the main steam lines inside the drywell are collected and routed outside containment to the main condenser. The common drain line has one isolation valve inside the drywell and one outside the containment.

Main Steam Isolation Valves

The MSIVs automatically isolate the nuclear system process barrier in the event a pipe break occurs, thereby limiting the loss of coolant and the release of radioactive materials from the nuclear steam supply system (NSSS). Two MSIVs are installed on each main steam line, one inside the drywell and the other just outside the primary containment. Closure of either of the two MSIVs acts to seal the primary containment in the event of a main steam line break.

Nuclear Pressure Relief System/Automatic Depressurization System

The nuclear pressure relief system is described and reviewed in Section 2.3.2.1, Nuclear Pressure Relief.

Accumulators

Accumulators for the reactor coolant system are described and reviewed in Section 2.3.3.6, Compressed Air.

MSIV Leakage Control System

The MSIV leakage control system is described and reviewed in Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection. With the change in the LOCA analyses to use the alternate source term methodology (License Amendment 160), the MSIV leakage control system is no longer credited for post-LOCA activity leakage mitigation.

Miscellaneous

Other piping components within the NB system serve a variety of purposes. The system includes piping and valves that are part of the RCPB, such as the reactor vessel head vents, vessel drain lines, and instrument lines supporting vessel level and pressure instrumentation. RCPB main steam piping supplies steam to the HPCI and RCIC turbines. The line from the closure head seal leak detection nozzle to the leak detection system is included.

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

- Maintain integrity of reactor coolant pressure boundary.
- Prevent over-pressurization of the reactor coolant pressure boundary by use of a pressure relief system.
- Limit the coolant blowdown rate from the reactor vessel in the event of a main steam line break outside the containment.
- Control radioactive material release and exposure to plant personnel during planned operations, abnormal operational transients and accidents.
- Reduce reactor vessel pressure in a LOCA situation in which the HPCI system fails to maintain the reactor vessel water level.

- Provide a reserve capacity of compressed air (accumulators) for those components requiring a supply of compressed air to provide engineered safety features and containment pressure boundary.
- Provide steam to the RCIC turbine and the HPCI turbine.
- Provide coolant injection path for HPCI, RHR, RCIC and RWCU.
- Support safety-related instrumentation.
- Support primary containment pressure boundary.

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

- Maintain piping and component integrity to support post-accident plate-out of fission products from 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 NB system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function (operation of SRVs and steam to HPCI and RCIC) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function (operation of SRVs and steam to HPCI and RCIC) that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63).

<u>UFSAR References</u>

Section 5.1	Section 5.2.1.1.5	Section 5.5.5	Section 8.4
Section 5.2.1.1.3	Section 5.2.2	Section 5.5.9	Table 3.2-1
Section 5.2.1.1.4	Section 5.5.4	Section 6.2.6	

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. SRV discharge piping and T-quenchers are reviewed in Section 2.3.2.1, Nuclear Pressure Relief. Components using compressed air or nitrogen are reviewed in Section 2.3.3.6, Compressed Air. Components downstream of the second MSIVs and within the plate-out boundary are reviewed in Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.1.7, Miscellaneous Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2).

For tables that include NB system component types and their component intended functions, see the LRA sections referenced above.

License Renewal Drawings

For additional details for NB components subject to aging management review, see the LRA drawings listed in the LRA sections referenced under “Components Subject to Aging Management Review.”

2.3.1.4 Reactor Recirculation

System Description

The purpose of the reactor recirculation system (system code B31) is to pump reactor coolant through the core and to control reactor power level through the effects of coolant flow rate on moderator void content.

The reactor recirculation system has two external loops, each consisting of a single stage, variable speed, centrifugal pump; suction and discharge gate valves; flow measuring element; controls and instrumentation; and associated piping. For each loop, a motor-generator set provides power of variable frequency and voltage to the electric motor that drives the recirculation pump. The reactor recirculation system loops are located inside the primary containment structure.

The internal portion of the recirculation loop consists of the jet pumps, which are part of the reactor assembly system (see Section 2.3.1.1).

Cooling water to the recirculation pump motors and seals is supplied through emergency equipment cooling water (EECW) system piping, which is routed into and out of the drywell from external supply and return flow tie-ins with the reactor building closed cooling water (RBCCW) system. Pump seals are supplied with purge flow from the control rod drive hydraulic control system (see Section 2.3.3.1).

The reactor recirculation system is not an engineered safety system and, apart from maintaining the RCPB, the recirculation pumps are not considered essential for safe plant shutdown under either normal or abnormal conditions. The RHR system uses reactor recirculation system piping in the RCPB as an injection path for low pressure coolant injection and for shutdown cooling.

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

- Provide a flow path for shutdown cooling and for low pressure coolant injection into the vessel.
- Support EECW system pressure boundary.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment pressure boundary.

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

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

UFSAR References

Section 1.2.2.5.3	Figure 5.5-1
Section 5.5.1	Figure 5.5-2
Section 9.A.3.2	

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary and non-Class 1 safety-related components of the reactor recirculation system are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Reactor recirculation system components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. Reactor recirculation system components that are part of the emergency equipment cooling water system supply to the recirculation pumps are reviewed in Section 2.3.3.5, Emergency Equipment Cooling Water. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.1.7, Miscellaneous Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2).

For tables that include reactor recirculation system component types and their component intended functions, see the LRA sections referenced above.

License Renewal Drawings

For additional details for reactor recirculation components subject to aging management review, see the LRA drawings listed in the LRA sections referenced under "Components Subject to Aging Management Review."

2.3.1.5 Neutron Monitoring

System Description

The purpose of the neutron monitoring system (system code C51) is to provide indication of neutron flux which can be correlated to power level for the entire range of flux conditions that can exist in the core. The system includes in-core neutron detectors and out-of-core electronic monitoring equipment which comprise six major subsystems: source range monitors (SRM), intermediate range monitors (IRM), local power range monitors (LPRM), traversing in-core probes (TIP), average power range monitors (APRM), and rod block monitors (RBM).

The SRM and IRM detectors and cable are located inside the reactor vessel in a dry tube sealed against reactor vessel pressure. A remote-controlled detector drive system moves the detector along the dry tube. The dry tubes which contain the SRM and IRM detectors form part of the reactor coolant pressure boundary.

Each LPRM detector assembly consists of four fission chambers located at different axial heights in the core. The detector assemblies are inserted through thimbles that are mounted permanently at the bottom of the core lattice and penetrate the bottom of the RPV. The thimbles extend down into the access area below the RPV where they terminate in a flange. The flange mates to the mounting flange on the in-core detector assembly. The detector assemblies are locked at the top end to the top fuel guide by means of a spring-loaded plunger. The LPRM detectors assemblies form part of the reactor coolant pressure boundary.

Each LPRM assembly also contains a calibration tube for a traversing in-core probe. The TIP subsystem provides a means to calibrate the individual LPRM sensors by correlating TIP signals to LPRM signals as the TIP is positioned in various radial and axial locations in the core by means of a drive mechanism. A TIP drive mechanism uses a fission chamber attached to a flexible drive cable. The cable is driven from outside the drywell by a gearbox assembly. The flexible cable is contained by guide tubes that penetrate the reactor core as part of the LPRM detector assembly. The system includes valves on each guide tube entering the primary containment. The guide tube enters containment through a bellows support assembly, which is evaluated as a structural component. A ball valve and a cable shearing valve are mounted in the guide tubing just outside the primary containment. The shear valve can cut the cable and close off the guide tube if required to support containment integrity.

The APRM system has four APRM channels, each of which uses electronic equipment that averages the output signals from a number of LPRM channels. The RBM system has two electronic instrument channels, each of which uses input signals from a number of LPRM channels.

Most neutron monitoring system components are electronic. The TIP guide tube penetration bellows support assembly, which supports the primary containment pressure boundary, is a structural component. The SRM and IRM detector dry tubes and the LPRM assemblies support the reactor coolant pressure boundary. The TIP guide tubes and valves support the primary containment pressure boundary. The mechanical components of the system have no other safety function.

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

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

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

UFSAR References

Section 7.1.2.1.4

Section 7.6.1.13

Components Subject to Aging Management Review

The SRM and IRM detector dry tubes and the LPRM assemblies are reviewed in Section 2.3.1.1.2, Reactor Vessel Internals. The TIP guide tubes and valves are reviewed in Section 2.3.2.6, Containment Penetrations. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.1.7, Miscellaneous Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2).

For tables that include neutron monitoring system component types and their component intended functions, see the LRA sections referenced above.

License Renewal Drawings

For additional details for neutron monitoring system components subject to aging management review, see the LRA drawings listed in the LRA sections referenced under "Components Subject to Aging Management Review."

2.3.1.6 Fuel and Reloads

System Description

The fuel and reloads system (system code J11) has only one component. The component type is "Fuel Assembly," and it is a representative component for the 764 fuel assemblies.

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

- Maintain integrity of reactor fuel assemblies.

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

UFSAR References

Section 4.1.2

Section 4.2

Components Subject to Aging Management Review

Because fuel assemblies are periodically replaced, no aging management review is required.

License Renewal Drawings

None

2.3.1.7 Miscellaneous Reactor Coolant 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 reactor coolant 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 Fermi 2, certain components and piping outside the safety class pressure boundary must be structurally sound 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, Scoping and Screening Results: Structures.

Pipe Whip, Jet Impingement, or Harsh Environments

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

The following reactor coolant systems are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) for physical interactions.

- Nuclear boiler (Section 2.3.1.3)
- Reactor recirculation (Section 2.3.1.4)
- Neutron monitoring (Section 2.3.1.5)

System Descriptions

The miscellaneous reactor coolant 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 LRA sections referenced above.

UFSAR References

See UFSAR sections listed in the LRA sections referenced above.

Components Subject to Aging Management Review

For each safety-to-nonsafety interface, nonsafety-related components connected to safety-related components were included up to one of the following:

(1) The first seismic anchor, which is defined as a device or structure that ensures that forces and moments are restrained in three orthogonal directions.

(2) An equivalent anchor (restraints or supports), which is defined as a boundary point that encompasses at least two supports in each of three orthogonal directions.

(3) A boundary determined using the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a flexible connection or the end of a piping run (such as a vent or drain line) or up to and including a base-mounted component.

(4) If the boundary could not be determined in accordance with (1), (2), or (3) above, then the boundary beyond the interface was determined from review of site-specific supporting analyses.

For spatial interaction, nonsafety-related components related to the reactor coolant systems containing oil, steam, or liquid and located in spaces containing safety-related equipment are subject to aging management review in this 10 CFR 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 a 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 2.3.1-4-x tables list the component types that require aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Series 3.2.1-4-x tables provide the results of the aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

System Code	System Name	Component Types	AMR Results
B21	Nuclear Boiler	Table 2.3.1-4-1	Table 3.1.2-4-1
B31	Reactor Recirculation	Table 2.3.1-4-2	Table 3.1.2-4-2
C51	Neutron Monitoring	Table 2.3.1-4-3	Table 3.1.2-4-3

License Renewal Drawings

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

System Code	System (System Code)	LRA Drawings	
B21	Nuclear Boiler	LRA-M-2081 LRA-M-2089	LRA-M-2090 LRA-M-3045
B31	Reactor Recirculation	LRA-M-2833 LRA-M-5358	LRA-M-5702-2
C51	Neutron Monitoring	LRA-M-5007	

**Table 2.3.1-4-1
Nuclear Boiler System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function[a]
Bolting	Pressure boundary
Condenser shell	Pressure boundary
Cylinder	Pressure boundary
Filter housing	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.1-4-2
Reactor Recirculation System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Cooler bonnet	Pressure boundary
Cooler shell	Pressure boundary
Eliminator	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.1-4-3
Neutron Monitoring System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Piping	Pressure boundary

a. 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.

2.3.2 Engineered Safety Features

The following systems are described in this section.

- Section 2.3.2.1, Nuclear Pressure Relief
- Section 2.3.2.2, Residual Heat Removal
- Section 2.3.2.3, 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, Containment Penetrations
- Section 2.3.2.7, Standby Gas Treatment
- Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2)

2.3.2.1 Nuclear Pressure Relief

System Description

The nuclear pressure relief system (NPRS) is part of the nuclear boiler system (system code B21), which is reviewed in Section 2.3.1.3.

The purpose of the NPRS is to limit any overpressure that occurs during abnormal operational transients. To protect against overpressure, pressure-operated safety/relief valves (SRVs) are provided to discharge steam from the NSSS to the suppression pool. The NPRS also acts to automatically depressurize the NSSS in the event of a loss of coolant accident (LOCA) in which the HPCI system fails to maintain reactor pressure vessel (RPV) water level. Depressurization of the NSSS allows the low-pressure core cooling systems to supply enough cooling water to cool the fuel adequately.

SRVs are located on the main steam lines between the RPV and the first isolation valve within the drywell. The SRVs provide four main protection functions:

- Overpressure, relief operation: The valves open by application of external power to limit a pressure rise. In the relief valve mode, any of these valves can be operated by manual action from the control room. No particular setpoint applies to this method of operation, as the operator may open a valve at his discretion for blowdown or test over a wide pressure range.
- Overpressure, safety operation: The valves function as safety valves and open to prevent NSSS overpressurization. These valves are self-actuated at their spring setpoint if not already opened for relief operation.
- Automatic depressurization system operation: Five valves are opened by indirectly operated devices (pneumatic) as part of the ECCS for events involving small breaks in the nuclear system process barrier. These valves, which are selected for automatic depressurization, are activated automatically and depressurize the NSSS sufficiently to permit the low pressure core injection and core spray systems to operate.
- Post-fire depressurization operation: Selected valves are manually operated from the control room using their pneumatic controls to enable use of low pressure makeup for certain post-fire shutdowns.

Fermi 2 is equipped with a "low-low set" design feature that changes the setpoints of selected SRVs following the initial opening of a number of SRVs. This ensures that following the initial pressurization, the pressure will be relieved by the two low-low set valves alone, and the remaining SRVs will not experience any subsequent actuations. The purpose of low-low set is to mitigate postulated loads caused by a second (after initial) opening of an SRV. The low-low set feature also serves to reduce the frequency of "stuck open relief valve" events.

A separate discharge line is provided for each of the 15 SRVs. The lines do not penetrate containment; they are routed to the suppression pool, or torus, through the drywell-to-torus vent lines. Inside the torus, they penetrate the vent line and terminate in a quencher device (T-quencher) located below the minimum water level in the primary containment suppression pool. A vacuum relief valve is provided on each SRV discharge line to prevent drawing an excessive amount of water up into the line as a result of steam condensation following termination of relief operation. In addition, the safety/relief blowdown control system ensures that subsequent SRV discharges will not occur during periods of elevated water legs in the discharge piping.

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

- Prevent over-pressurization of the reactor coolant pressure boundary by use of a pressure relief system.
- Reduce reactor vessel pressure in a LOCA situation in which the HPCI system fails to maintain the reactor vessel water level.

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

The NPRS performs the following intended functions for 10 CFR 54.4(a)(3).

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

UFSAR References

Section 5.1	Section 5.2.2
Section 5.2.1.1.3	Table 3.2-1

Components Subject to Aging Management Review

Components using compressed air or nitrogen are reviewed in Section 2.3.3.6, Compressed Air. Components downstream of the second MSIVs and within the plate-out boundary are reviewed in Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection. The SRVs are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

Remaining NPRS components (SRV discharge piping and T-quenchers) 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 drawing.

LRA-M-2089

Table 2.3.2-1
Nuclear Pressure Relief System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Flex connection	Pressure boundary
Piping	Pressure boundary
Quencher	Flow control Pressure boundary
Screen	Filtration
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.2.2 Residual Heat Removal

System Description

The purpose of the residual heat removal (RHR) system (system codes E11, E61) is to provide residual heat removal capability during normal shutdown and to restore and maintain the coolant inventory in the reactor vessel so that the core is adequately cooled after a LOCA. The RHR system provides post-LOCA cooling for the drywell and suppression pool, thereby removing heat from primary containment to reduce containment pressure and temperature. The RHR system also provides the ultimate heat sink for cooling of safety-related plant equipment.

The RHR system code, E11, includes the RHR system itself and subsystems of the ultimate heat sink, or RHR complex. The residual heat removal service water (RHRSW) system and major mechanical support components of the RHR complex, including the mechanical draft cooling tower system, are part of the E11 system code. The RHR complex and the RHRSW system are described in Section 2.3.3.3, Service Water.

System code E61 was assigned to an alternate decay heat removal system, which was subsequently not installed. The system includes a single safety-related valve whose only function is to support the RHR system pressure boundary. Consequently, the valve is reviewed with the RHR system.

The major equipment of the RHR system consists of two heat exchangers and four main system pumps arranged in two loops. Each loop consists of a heat exchanger, two main system pumps in parallel, and associated piping. The two loops of the RHR system are cross-connected by a single header, making it possible to supply either loop from the pumps in the other loop. Water is supplied through a low-pressure regulator and two check valves to ensure that the RHR discharge piping is continuously filled. This arrangement precludes water hammer effects. The shell-and-tube heat exchangers are cooled by the RHR service water system. RHR pump suction can be supplied from the suppression pool, reactor recirculation system, or fuel pool cooling and cleanup system depending on the mode of operation. These modes of operation are as follows:

- Shutdown cooling.
- Containment cooling (containment spray and suppression pool cooling).
- Low pressure coolant injection (LPCI).
- Fuel pool cooling assist.

Shutdown cooling is placed in operation during a normal reactor shutdown and cooldown. The initial phase of nuclear system cooldown is accomplished by sending steam to the main condenser. When the nuclear system temperature and pressure have decreased such that the vacuum in the main condenser cannot be maintained, the RHR system is placed in the shutdown cooling mode of operation to complete the cooldown. Reactor coolant is pumped from one of the reactor recirculation system loops by one or both of the RHR main system pumps and is discharged through the RHR heat exchangers, where heat is transferred to the RHR service water system. Reactor coolant can be returned to the reactor through either reactor recirculation system loop.

The containment cooling mode of the RHR system is used to remove heat from the suppression pool, the suppression chamber, and the drywell. Containment cooling is provided for post-accident conditions by two modes of RHR system operation.

In the containment spray mode, water pumped through the RHR heat exchangers is diverted to spray headers in the drywell and above the suppression pool. The spray removes energy from the drywell atmosphere by condensing the water vapor. The drywell spray collects in the bottom of the drywell until the water level rises to the level of the pressure suppression chamber vent lines and then overflows to the suppression pool. Part of this flow can be directed to the suppression chamber spray ring to cool any noncondensable gases collected in the free volume above the suppression pool.

In the suppression pool cooling mode of containment cooling, the RHR system limits the water temperature increase following a blowdown. The suppression pool cooling subsystem cools the suppression pool by using the RHR pumps and heat exchangers in a closed loop with the suppression pool. During this mode of operation, water is pumped from the suppression pool through the RHR system heat exchanger and back to the suppression pool.

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 RHR system pumps take suction from the suppression pool and discharge to the reactor vessel into the core region through one of the reactor recirculation system 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 lines. LPCI operation provides protection to the core for a large break in the nuclear system when the reactor vessel water level cannot be maintained. LPCI also provides protection for a small break in which the vessel water level cannot be maintained and the automatic depressurization system has operated to lower the reactor vessel pressure so that LPCI and core spray systems start to provide core cooling.

The RHR system can be connected to the fuel pool cooling and cleanup system so that the RHR heat exchangers can assist fuel pool cooling during overload conditions. In this mode, either loop of the RHR system can draw suction from the fuel pool skimmer surge tank, pass the water through one of the RHR heat exchangers, and return the water to the fuel pool.

The system includes valves and instrument lines supporting drywell pressure instrumentation.

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

- In conjunction with other emergency core cooling systems, restore and maintain water level in the reactor vessel for cooling after a loss of coolant accident.
- Transfer reactor core decay heat and sensible heat from the containment to the RHR service water system after a loss of coolant accident.
- Reduce containment pressure by spraying water into the suppression chamber to condense steam which may be present due to excess bypass leakage from the drywell after a loss of coolant accident.
- Remove decay and sensible heat from the reactor core to cooldown and maintain the reactor in a cold shutdown condition.
- Maintain integrity of reactor coolant pressure boundary.
- Support safety-related instrumentation.
- Support primary containment pressure boundary.

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

- Assist the fuel pool cooling and cleanup system in removing decay heat from fuel assemblies stored in the fuel pools.
- 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 function for 10 CFR 54.4(a)(3).

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

<u>UFSAR References</u>

Section 5.2.1.1.10	Section 7.1.2.1.27
Section 5.5.7	Section 7.3.1.2.4
Section 6.2.2	Section 7.4.1.3
Section 6.3.2	

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Components of the RHRSW and RHR complex support equipment are reviewed in Section 2.3.3.3, Service Water. RHR system components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. Nonsafety-related components of the system (including the RHRSW and the RHR complex described in Section 2.3.3.3, Service Water) that are not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining RHR system components, including the alternate decay heat removal system valve, 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-M-2048	LRA-M-2087	LRA-M-5444
LRA-M-2083	LRA-M-4100	LRA-I-2400-10
LRA-M-2084	LRA-M-5357	

Table 2.3.2-2
Residual Heat Removal System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Flow element	Flow control Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Nozzle	Flow control Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Separator	Filtration Pressure boundary
Strainer	Filtration
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.2.3 Core Spray

System Description

The purpose of the core spray system (system code E21) is to provide low pressure coolant flow directly to the core fuel elements in the event of a loss-of-coolant accident. The core spray system provides protection to the core for a large break in the nuclear system when the reactor vessel water level cannot be maintained. Core spray also provides protection for a small break in which the vessel water level cannot be maintained and the automatic depressurization system has operated to lower the reactor vessel pressure so that LPCI and core spray systems start to provide core cooling.

The core spray system consists of two independent pump loops that deliver cooling water from the suppression pool to independent spray spargers over the core. Each loop consists of two motor driven pumps with suction and discharge connected in parallel, a spray sparger in the reactor vessel above the core, piping and valves to convey water from the suppression pool to the pumps and to the sparger, and the associated controls and instrumentation.

Each loop has a full flow test line to route the suppression pool water from the pump discharge to the suppression chamber. The pump discharge lines are provided with a low-flow bypass line to protect the core spray pumps during operation at high vessel pressure. A normally isolated connection from the condensate storage tank to the pump suction provides for system testing during plant shutdown.

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

- In conjunction with other emergency core cooling systems, supply water to the reactor vessel for core cooling after a loss of coolant accident.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment pressure boundary.

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

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

UFSAR References

Section 5.2.1.1.11

Section 6.3.2.2.3

Section 7.3.1.2.3

Components Subject to Aging Management Review

The core spray spargers are evaluated with the vessel internals in Section 2.3.1.1.2, Reactor Vessel Internals. Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Core spray system components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. One core spray system component at the interface with the condensate storage and transfer system is reviewed in Section 2.3.4.2, Feedwater and Standby Feedwater. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining core spray system 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-M-2034

LRA-M-4100

Table 2.3.2-3
Core Spray System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Flow element	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Separator	Filtration Pressure boundary
Strainer	Filtration
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.2.4 High Pressure Coolant Injection

System Description

The purpose of the high pressure coolant injection (HPCI) system (system code E41), which forms part of the ECCS, is to provide reactor core cooling in the event of a small break loss of coolant accident that does not result in rapid depressurization of the reactor coolant system. For such conditions, the HPCI system maintains sufficient reactor water inventory until the reactor is depressurized to a level where the low pressure core injection (LPCI) system or core spray system can be placed into operation. The HPCI system consists of a steam turbine assembly, booster pump, gear reducer, main pump, barometric condenser, lubrication and control oil system, and associated piping, valves, controls, and instrumentation.

Turbine-driven pumps (booster and main) are used to pump water from the condensate storage tank or the suppression pool (torus) to the reactor vessel via a feedwater line. The HPCI system initially injects water from the nonsafety-related condensate storage tank. When the water level in the tank falls below setpoint level or when suppression pool level is high, the pump suction is automatically transferred to the suppression pool, which is the safety-related long-term source of water.

The HPCI turbine is driven by steam from the reactor pressure vessel. Exhaust steam from the HPCI turbine is discharged to the suppression pool. The turbine gland seals, stop valve leakoff, and control valve leakoff drain to a barometric condenser, where moisture is pumped by a condensate pump to the radwaste system whenever a high level is detected in the barometric condenser vacuum tank. During HPCI operation, condensate in the vacuum tank is routed to the booster pump suction. Operation of the barometric condenser components, which consist of the barometric condenser condensate pump, the barometric condenser vacuum pump, and the barometric condenser water level instrumentation, prevents outleakage from the turbine shaft seals. Failure of the barometric condenser components does not prevent the HPCI system from providing water to the RPV; however, the components are conservatively included in the scope of license renewal.

A minimum flow bypass line to the suppression pool is provided to protect the pump during startup and shutdown.

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

- Provide reactor core cooling in the event of a small break loss of coolant accident that does not result in rapid depressurization of the reactor coolant system.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment pressure boundary.

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

UFSAR References

Section 1.2.2.9.11.1	Section 7.3.1.2.1
Section 6.3.2.2.1	Section 8.4.2.3

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. HPCI system components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. A small number of HPCI system components at the interface with the condensate storage and transfer system are reviewed in Section 2.3.4.2, Feedwater and Standby Feedwater. A small number of components supporting the condensate storage tank instrumentation are reviewed in Section 2.3.4.1, Condensate Storage and Transfer. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining HPCI system 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-M-2034	LRA-M-2006	LRA-M-5708-2
LRA-M-2035	LRA-M-4100	
LRA-M-2043	LRA-I-2679-01	

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

Component Type	Intended Function
Bolting	Pressure boundary
Condenser	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Separator	Pressure boundary
Sight glass	Pressure boundary
Strainer	Filtration
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Turbine casing	Pressure boundary
Valve body	Pressure boundary

2.3.2.5 Reactor Core Isolation Cooling

System Description

The purpose of the reactor core isolation cooling (RCIC) system (system code E51) is to provide makeup water for core cooling in the event reactor isolation is accompanied by loss of flow from the reactor feedwater system. The RCIC system uses a steam-driven turbine pump unit and operates automatically with sufficient coolant flow to maintain adequate water levels in the reactor pressure vessel.

The RCIC system consists of a steam-driven turbine-pump unit and associated valves and piping capable of delivering makeup water to the RPV. Suction piping is provided from the condensate storage tank and the suppression pool. Pump suction is usually lined up to the condensate storage tank but is automatically switched to the suppression pool on low condensate storage tank level or when suppression pool level is high. Water from either source is pumped into the reactor vessel via a feedwater line. The RCIC system includes one turbine-driven pump, one barometric condenser DC vacuum pump, one vacuum DC condensate pump, lubrication and control oil system components, automatic valves, control devices for this equipment, sensors, and logic circuitry.

The power source for the turbine-pump unit is the steam generated in the reactor pressure vessel by core decay heat. Steam from the reactor pressure vessel is directed to the turbine and discharged to the suppression pool. Condensate from the turbine drains into the barometric condenser. Cooling water for the RCIC turbine lube-oil cooler and barometric condenser is supplied from the discharge of the pump. A minimum flow bypass line to the suppression pool is provided to protect the pump during startup and shutdown.

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 accompanied by a loss of coolant flow from the feedwater system to provide adequate core cooling and control of the reactor vessel water level.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment pressure boundary.

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).

UFSAR References

Section 5.2.1.1.13	Section 7.4.1.1.3
Section 5.5.6	Section 8.4.2.3
Section 7.1.2.1.20	

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. RCIC system components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. A small number of RCIC system components at the interface with the condensate storage and transfer system are reviewed in Section 2.3.4.2, Feedwater and Standby Feedwater. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining RCIC system 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-M-2044	LRA-M-2045
LRA-M-2034	LRA-M-5709-2

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

Component Type	Intended Function
Bolting	Pressure boundary
Breather	Filtration
Condenser	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Rupture disc	Pressure boundary
Separator	Filtration Pressure boundary
Sight glass	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Turbine casing	Pressure boundary
Valve body	Pressure boundary

2.3.2.6 Containment Penetrations

As described in UFSAR Section 6.2.1, there are two passive provisions for containment of possible postaccident airborne contamination: the primary containment system and the secondary containment system. A perspective drawing illustrating these systems and their relationship is presented in UFSAR Figure 5.1-4.

The primary containment is a pressure suppression system consisting of the following:

- A drywell that houses the reactor pressure vessel (RPV), the reactor coolant recirculating loops, and other branch connections of the reactor coolant system.
- A pressure suppression chamber that stores a large volume of water.
- A vent system connecting the drywell and the pressure suppression chamber water.
- A vacuum relief system.
- Isolation valves.
- Service equipment.

Primary containment penetrations are designed for peak transient conditions to be expected during a LOCA. They will withstand, or are shielded from, the forces caused by impingement of fluid from the rupture of the largest local pipe or connection.

The reactor building, in conjunction with the reactor building heating and ventilation system and the standby gas treatment system (SGTS), constitutes the secondary containment. The reactor building completely encloses the reactor and its pressure suppression primary containment. This building provides secondary containment when the primary containment is closed and in service. During times when the primary containment is open, as it is during refueling, the reactor building provides primary containment. Penetrations for piping and ducts are designed for leakage characteristics consistent with containment requirements for the entire building.

Additional details of the primary containment structure and the reactor building are provided in Section 2.4.1, Reactor/Auxiliary Building and Primary Containment.

Penetrations in the primary and secondary containments provide openings for equipment or personnel to pass through the containment boundaries and still maintain containment integrity. Mechanical components associated with primary and secondary containment penetrations that were not reviewed with other systems are included in this review. The grouping of 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. This review includes mechanical components, primary piping and valves.

The following mechanical systems have containment penetration components included in this review.

System Code	System with Containment Penetration included in this Review	LRA Section where System is Described
C36	Dedicated Shutdown	Section 2.3.3.11, Heating, Ventilation and Air Conditioning
C51	Neutron Monitoring	Section 2.3.1.5, Neutron Monitoring
G41	Fuel Pool Cooling and Cleanup	Section 2.3.3.4, Fuel Pool Cooling and Cleanup
G51	Torus Water Management	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P34	Post-Accident Sampling	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
T23	Primary Containment	See below.
T48	Containment Atmospheric Control	Section 2.3.3.13, Containment Atmospheric Control

Fermi 2 has a system code (T23) referred to as the "primary containment" system.

System Description

The primary containment system code, T23, includes various mechanical, electrical and structural components and equipment that are related to or form part of the primary containment. This system includes safety-related mechanical components that support the containment vacuum breakers and personnel air locks. These components support the primary containment pressure boundary.

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

- Support the primary containment pressure boundary.

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

UFSAR References

Section 6.2

Components Subject to Aging Management Review

Components in the Class 1 boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. The structural portions of the containment penetrations (penetration pipe sleeves) are addressed in Section 2.4.1, Reactor/Auxiliary Building and Primary Containment (including construction and spare penetrations). The internals of electrical penetration assemblies are reviewed in Section 2.5, Scoping and Screening Results: Electrical and Instrumentation and Control Systems.

System code T23 components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. One system code T23 component supporting integrated leak rate testing instrumentation is reviewed in Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2). Safety-related components supporting the primary containment pressure boundary that are not included in other system reviews 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-M-2048	LRA-M-3445-1
LRA-M-3445	LRA-M-4100
LRA-M-2223	LRA-I-2400-10
LRA-M-2224	LRA-I-2679-01

**Table 2.3.2-6
Containment Penetrations
Components Subject to Aging Management Review**

Component Type	Intended Function
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.2.7 Standby Gas Treatment

System Description

The purpose of the standby gas treatment system (SGTS) (system code T46) is to minimize the release-related offsite dose rates by permitting the venting and purging of both the primary and the secondary containment atmospheres under accident or abnormal conditions, and at the same time containing any airborne particulate or halogen contamination that might be present. The SGTS permits controlled ventilation of the secondary containment area by maintaining it under slightly negative pressure with respect to the outside atmosphere to ensure that any air leaving is filtered to remove particulates and halogens. The system is also capable of filtering gases exhausted from the primary containment and the HPCI barometric condenser.

The SGTS consists of two identical full-capacity fan/filter trains that draw from a common duct within the secondary containment. Each fan/filter train has an exhaust fan that draws air through the system dampers and duct work and through the filtration unit, exhausting it to the SGTS stack. The filtration unit contains a moisture separator, an electric heater, a prefilter, high-efficiency particulate filters, and an iodine filter. The charcoal adsorber within the filtration unit is protected against high temperature and potential fire with a cooling fan and a self-contained carbon dioxide unit.

The fan/filter trains are supplied by a duct within the secondary containment that is aligned to draw from the reactor building exhaust system following an accident. The secondary containment is drawn down to less than atmospheric pressure to limit any primary containment leakage that could bypass the SGTS filter units. The SGTS fan/filter trains can also be aligned to process air from the containment purge and vent system or the refueling area, or effluent from the HPCI barometric condenser via the common duct.

A severe accident that is beyond the design basis of the plant may result in over-pressurization of the primary containment. The SGTS valves may be lined up to relieve this over-pressure from the primary containment torus through the torus hardened vent system that discharges directly to the environment.

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

- Minimize the release-related offsite dose rates by processing the primary containment atmosphere, the secondary containment atmosphere, and effluent from the HPCI barometric condenser, during accident and abnormal conditions to remove airborne particulate and/or halogen contamination.
- Limit the unfiltered air from the secondary containment during periods of primary and secondary containment isolation.
- Support primary and secondary containment pressure boundary.

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

- Perform a function (support HPCI barometric condenser and charcoal adsorber fire protection) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

UFSAR References

Section 6.2.3

Section 7.1.2.1.16

Section 7.3.6

Components Subject to Aging Management Review

Charcoal adsorber fire protection equipment is reviewed in Section 2.3.3.8, Fire Protection – Carbon Dioxide and Halon. System components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining SGTS system components 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-M-2709

LRA-I-2649-1

LRA-I-2181-06

Table 2.3.2-7
Standby Gas Treatment System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Chamber	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Flow element	Pressure boundary
Moisture separator	Filtration
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

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

System Description

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 Failures

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 Fermi 2, certain components and piping outside the safety class pressure boundary must be structurally sound 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, Scoping and Screening Results: Structures.

Pipe Whip, Jet Impingement, or Harsh Environments

Systems containing nonsafety-related high energy lines that can affect safety-related equipment are included in the review for the criterion of 10 CFR 54.4(a)(2). 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.

- Residual heat removal (Section 2.3.2.2) (including the RHRSW and RHR complex described in Section 2.3.3.3)
- Core spray (Section 2.3.2.3)
- High pressure coolant injection (Section 2.3.2.4)
- Reactor core isolation cooling (Section 2.3.2.5)
- Primary containment (Section 2.3.2.6)
- Standby gas treatment (Section 2.3.2.7)

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.

UFSAR References

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

Components Subject to Aging Management Review

For each safety-to-nonsafety interface, nonsafety-related components connected to safety-related components were included up to one of the following:

(1) The first seismic anchor, which is defined as a device or structure that ensures that forces and moments are restrained in three orthogonal directions.

(2) An equivalent anchor (restraints or supports), which is defined as a boundary point that encompasses at least two supports in each of three orthogonal directions.

(3) A boundary determined using the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a flexible connection or the end of a piping run (such as a vent or drain line) or up to and including a base-mounted component.

(4) If the boundary could not be determined in accordance with (1), (2), or (3) above, then the boundary beyond the interface was determined from review of site-specific supporting analyses.

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 10 CFR 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 to provide reasonable assurance that those analysis assumptions remain valid through the period of extended operation.

Series 2.3.2-8-x 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-x 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 Code	System	Component Types	AMR Results
E11, E61	Residual heat removal	Table 2.3.2-8-1	Table 3.2.2-8-1
E21	Core spray	Table 2.3.2-8-2	Table 3.2.2-8-2
E41	High pressure coolant injection	Table 2.3.2-8-3	Table 3.2.2-8-3
E51	Reactor core isolation cooling	Table 2.3.2-8-4	Table 3.2.2-8-4
T23	Primary containment	Table 2.3.2-8-5	Table 3.2.2-8-5
T46	Standby gas treatment	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 Code	System Name	LRA Drawings	
E11, E61	Residual heat removal	LRA-M-2083 LRA-M-2084 LRA-M-N-2052	LRA-M-N-2053 LRA-M-N-2054
E21	Core spray	LRA-M-2034	
E41	High pressure coolant injection	LRA-M-2035 LRA-M-2043	
E51	Reactor core isolation cooling	LRA-M-2044 LRA-M-2045	
T23	Primary containment	LRA-M-3445-1	
T46	Standby gas treatment	LRA-M-2709	

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[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Valve body	Pressure boundary

a. 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[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Strainer housing	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Sight glass	Pressure boundary
Valve body	Pressure boundary

a. 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[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Valve body	Pressure boundary

a. 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
Primary Containment System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

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

a. 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
Standby Gas Treatment System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Duct	Pressure boundary

a. 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, Control Rod Drive
- Section 2.3.3.2, Standby Liquid Control
- Section 2.3.3.3, Service Water
- Section 2.3.3.4, Fuel Pool Cooling and Cleanup
- Section 2.3.3.5, Emergency Equipment Cooling Water
- Section 2.3.3.6, Compressed Air
- Section 2.3.3.7, Fire Protection – Water
- Section 2.3.3.8, Fire Protection – Carbon Dioxide and Halon
- Section 2.3.3.9, Combustion Turbine Generator
- Section 2.3.3.10, Emergency Diesel Generator
- Section 2.3.3.11, Heating, Ventilation and Air Conditioning
- Section 2.3.3.12, Control Center Heating, Ventilation and Air Conditioning
- Section 2.3.3.13, Containment Atmospheric Control
- Section 2.3.3.14, Plant Drains
- Section 2.3.3.15, Fuel Oil
- Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection
- Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

2.3.3.1 Control Rod Drive

System Description

The purpose of the control rod drive hydraulic control system (system code C11), also known as 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 such that no fuel damage results from any abnormal operating transient. The control rods are part of the reactor assembly (system code B11). The CRD system includes the control rod drive mechanisms and the supporting hydraulics components, including pumps, accumulators, piping, valves, instruments and controls.

The CRD mechanism (drive) used for positioning the control rod in the reactor core is a double-acting, mechanically latched, hydraulic cylinder using water as its operating fluid. The individual drives are mounted on the bottom head of the reactor pressure vessel. The CRD housings, which are part of the reactor assembly (B11), are welded into the reactor vessel with their lower end terminating in a flange below the vessel to which the drive is bolted.

The CRD hydraulic system supplies and controls the pressure and flow to and from the drives through hydraulic control units (HCU). Each HCU controls the water flow to and from its associated drive during normal operation 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 the HCU and the exhaust header and is returned to the reactor vessel via the HCUs of the nonmoving drives.

The scram accumulator, part of each HCU, stores sufficient energy to fully insert a control rod when reactor pressure is low. It is not required in order to scram the control rod when the reactor is close to or at full pressure, though the accumulator does provide an additional energy boost to reactor pressure. The accumulator is a hydraulic cylinder with a free-floating piston. The piston separates the water on top from the nitrogen below. A check valve in the accumulator charging line prevents loss of water pressure in the event supply pressure is lost. Accumulator charging pressure is established by the discharge pressure of the system supply pump. During scram the scram inlet (and outlet) valves open and permit the stored energy in the accumulators to discharge into the CRDs. There are two supply pumps, with one normally operating to pressurize the system with water from the condensate storage and transfer system.

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

The alternate rod insertion (ARI) components of the CRD system are designed to mitigate the potential consequences of an ATWS event. The ARI enables the insertion of reactor control rods by depressurizing the scram pilot valve air header through valves that are redundant and diverse from the backup scram valves initiated by the reactor protection system. The redundant ARI initiation signal results in energizing the eight ARI solenoid valves. Two ARI valves in series with the backup scram valves also have parallel functioning check valves to vent air from the air supply line in case an ARI valve fails. These two valves and four other ARI valves vent the hydraulic control unit scram valve pilot air headers to the atmosphere in order to depressurize the headers and scram all rods. Two additional valves vent the portion of the scram air header that serves the scram discharge volume drain and vent lines, closing the vent and drain valves and isolating the scram discharge volume.

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

- Insert all control rods into the core to quickly shut down the reactor in response to a manual or automatic signal.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment pressure boundary.

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 ATWS (10 CFR 50.62).
- Perform a function (RPV isolation) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function (RPV isolation) that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63).

UFSAR References

Section 4.5.2.2

Section 7.6.1.18

Components Subject to Aging Management Review

The control rod drive mechanisms are Class 1 components supporting the reactor coolant pressure boundary and are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. A small number of CRD system components at the interface with the condensate storage and transfer system are reviewed in Section 2.3.4.2, Feedwater and Standby Feedwater. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining CRD system 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 drawings.

LRA-M-5449

LRA-M-2081

Table 2.3.3-1
Control Rod Drive System
Components Subject to Aging Management Review

Component Type	Intended Function
Accumulator	Pressure boundary
Bolting	Pressure boundary
Filter	Filtration
Filter housing	Pressure boundary
Piping	Pressure boundary
Rupture disc	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.2 Standby Liquid Control

System Description

The purpose of the standby liquid control (SLC) system (system code C41) is to provide an alternate method of reactor core reactivity control in the event the control rod drive system is not available. The system is sized to counteract the positive reactivity effect in decreasing power from rated power to the cold-shutdown condition. The SLC system is also credited for injecting sodium pentaborate into the reactor coolant system after a design basis LOCA in order to control ECCS water pH to prevent iodine re-evolution. The SLC system can be manually initiated to provide this function.

The major components of the SLC system consist of a storage tank, two positive displacement pumps, two explosive valves, and two check valves between the explosive valves and the reactor. The flow path is from the storage tank through the pumps, explosive valves, check valves, and into the reactor through the differential pressure and standby liquid control line nozzle, where it discharges below the core support plate and mixes with the cooling water rising through the core.

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

- Provide the capability of controlling suppression pool pH following a LOCA in the event of fuel failure.
- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment pressure boundary.

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

- Provide the capability of controlling suppression pool pH following a LOCA in the event of fuel failure.
- 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 functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for ATWS (10 CFR 50.62).
- Perform a function (RPV isolation) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

UFSAR References

Section 1.2.2.10.1	Section 7.1.2.1.21
Section 4.5.2.4	Section 7.4.1.2
Section 5.2.1.1.9	Section 15.8.1

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining SLC system components are reviewed as listed below.

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-M-2082

Table 2.3.3-2
Standby Liquid Control System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Heater housing	Pressure boundary
Thermowell	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.3 Service Water

System Description

The review of the service water system includes the emergency equipment service water (EESW) system (system code P45) and the RHR service water (RHRSW) system and RHR complex support equipment (included in RHR system code E11).

Emergency Equipment Service Water

The purpose of the EESW system (system code P45) is to provide cooling water to the emergency equipment cooling water (EECW) heat exchangers and transfer heat to the ultimate heat sink. The EESW system consists of two independent and redundant cooling water flow trains, Division I and Division II, supplying cooling water to the corresponding Division I and II EECW heat exchangers. Each division is equipped with a full-capacity vertical pump that takes suction from its respective RHR complex reservoir, circulates cooling water through the cold side of the divisional (primary or backup) EECW heat exchanger and the EESW system piping and valves, and returns the flow to one of the two-celled mechanical-draft cooling towers located over each divisional RHR complex reservoir (or directly to the reservoir during cold weather operation). A back-pressure limiting valve is provided on each pump discharge for minimum flow protection. Flow through the valve is routed back to the reservoir. Heat from the EECW heat exchangers is rejected to the reservoir heat sink or to the atmosphere via the mechanical-draft cooling towers.

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

- Transfer heat from the EECW heat exchangers to the ultimate heat sink.

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

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

RHR Service Water

The RHRSW system (system code E11) consists of two redundant cooling water flow trains, Division I and Division II, supplying cooling water to the corresponding Division I and II RHR heat exchangers. Each division is equipped with two half-capacity vertical pumps that take suction from the RHR complex reservoir, circulate the cooling water through the tube side of the RHR heat exchanger and the RHRSW system piping and valves, and return the flow to the mechanical-draft cooling towers located over each divisional reservoir, or directly to the reservoir during cold weather operation. The return flow piping header to the cooling tower is equipped with a sample cooler for sampling RHRSW return flow. A pressure control valve is provided on each pump discharge for minimum flow protection. Flow through the pressure control valve is routed back to the reservoir. A cross-tie in Division II is provided at the discharge of a pair of RHRSW pumps and the RHR heat exchanger shell side discharge piping to facilitate flooding the reactor vessel in the unlikely event that all RHR (low pressure coolant injection) and core spray pumps fail to operate following a postulated LOCA.

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

- Transfer heat from the RHR heat exchangers to the ultimate heat sink.

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

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

RHR Complex Support Equipment

The RHR complex (system code E11) consists of a water supply reservoir; a means for heat rejection (cooling towers); a makeup and decanting system; and associated pumps, piping, and instrumentation. The RHR complex also includes a standby power source comprising four emergency diesel generators (EDGs) and related emergency diesel generator service water (EDGSW) pumps, which are part of system code R30, and the emergency equipment service water (EESW) pumps and related components from system code P45.

The RHR complex reservoir consists of two half-capacity reinforced-concrete structures. The reservoirs are connected by redundant valved lines to permit access to the combined inventory of the two reservoirs to either division in the event of a mechanical failure in one of the divisions. Separate piping systems supply service water from the RHRSW, EESW and EDGSW pumps to their respective heat loads. The RHRSW, EESW and EDGSW return lines are combined for each division and are routed to the reservoir via the cooling towers.

A two-cell induced-draft cooling tower is located over each division reservoir. Each tower cools one division of the plant load (return flow from one RHRSW loop, one EESW loop and two EDGSW loops). The motor-driven fan in each cooling tower cell is provided with a brake system to prevent overspeed from the design-basis tornado.

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

- Provide cooling of service water returned from safety-related plant equipment.
- Maintain a source of cooling water for the RHRSW, EESW and EDGSW systems.

The RHR complex support equipment 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 RHR complex support equipment has the following intended function for 10 CFR 54.4(a)(3).

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

UFSAR References

EESW

Section 9.2.2

Section 9.2.5

RHRSW

Section 9.2.5

RHR Complex Support Equipment

Section 9.2.5

Components Subject to Aging Management Review

Nonsafety-related components of the RHRSW system and RHR complex not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, Miscellaneous ESF Systems in Scope for 10 CFR 54.4(a)(2). Nonsafety-related components of the EESW system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining service water components are reviewed as listed below.

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-M-N-2052	LRA-M-2083	LRA-M-5444
LRA-M-N-2053	LRA-M-2084	LRA-I-2181-04
LRA-M-N-2054	LRA-M-5357	

Table 2.3.3-3
Service Water System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Flex connection	Pressure boundary
Flow element	Pressure boundary
Nozzle	Flow control
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.4 Fuel Pool Cooling and Cleanup

System Description

This review includes the fuel pool cooling and cleanup system (FPCCS) (system code G41) and the fuel service and handling equipment (system codes F11, F12, F13, F14, F15, F16, F17, F19).

Fuel Pool Cooling and Cleanup

The purpose of the FPCCS is to remove the decay heat produced by stored spent fuel assemblies. The FPCCS cools the spent fuel pool by transferring decay heat through heat exchangers to the reactor building closed cooling water (RBCCW) system. Water purity and clarity in the spent fuel pool, reactor well pool, and dryer-separator storage pool are maintained by filtering and demineralizing the pool water.

The system consists of two fuel pool cooling pumps; two heat exchangers; two filter-demineralizers; two skimmer surge tanks; and associated piping, valves, and instrumentation. The two fuel pool cooling pumps are connected in parallel, as are the two heat exchangers. The pumps circulate the spent fuel pool water in a closed loop, taking suction from the skimmer surge tanks through the heat exchangers, circulating the water through the filter-demineralizers, and discharging below the normal water level in the fuel storage pool. The cooled water traverses the pool, picking up heat and debris before starting a new cycle by discharging over the skimmer weirs and scuppers into the skimmer surge tanks. The normal makeup water source for the system is provided from the condensate storage tank to the skimmer surge tanks. The FPCCS serves no safety function.

Backup cooling and makeup is provided to the spent fuel pool by means of a permanently piped cross tie to the RHR system. In this mode of operation, one RHR pump and the corresponding RHR division heat exchanger will provide the means to cool the spent fuel pool.

FPCCS connection lines with the condensate storage and transfer, radioactive waste, and condenser and auxiliaries systems pass through the wall between the reactor building and the turbine building. Components of these lines form part of the secondary containment pressure boundary.

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

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

- Backup makeup and cooling for spent fuel storage pool from RHR system.
- Support the secondary containment pressure boundary.

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

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

Fuel Service and Handling Equipment

The fuel service and handling equipment system codes (system codes F11, F12, F13, F14, F15, F16, F17, F19) consist of equipment used for moving fuel during refueling and other outage inspections and tasks as well as spent fuel storage. With the exception of system code F16 (reactor vessel fuel storage equipment), the few components that are classified as safety-related (the RPV head strongback [system code F13] the dryer and separator sling [system code F13], and a plug for the "fuel servicing equip gamma scan collimator" [system code F11]), are not mechanical system components and do not perform an intended function in accordance with 10 CFR 54.4(a)(1).

The purpose of the reactor vessel fuel storage equipment system (system code F16) is to provide storage for spent fuel. There are two types of high-density spent fuel storage racks (Holtec and Oat) being used. The Oat racks use Boraflex as a neutron absorber; the Holtec racks use Boral. The structural support of fuel provided by the stainless steel racks and the neutron absorption performed by Boraflex and Boral are intended functions in accordance with 10 CFR 54.4(a)(1). System code F16 also includes the nonsafety-related new fuel racks, which provide structural support for new fuel.

The reactor vessel fuel storage equipment system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide neutron absorption in the spent fuel pool.
- Provide structural support of fuel assemblies in the spent fuel pool.

The reactor vessel fuel storage equipment 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 fuel service and handling equipment has no intended functions for 10 CFR 54.4(a)(3).

UFSAR References

FPCC	*Fuel Service and Handling Equipment*	
Section 1.2.2.15.2	Section 9.1.2.2.2	Table 9.1-5
Section 7.6.1.15	Section 9.1.4.2	
Section 9.1.3	Section 12.1.1.1	

Components Subject to Aging Management Review

A small number of FPCCS components at the interface with the RHR system are reviewed in Section 2.3.2.2, Residual Heat Removal. The skimmer surge tanks are reinforced concrete structures completely lined with seam-welded stainless steel plates and are therefore reviewed in Section 2.4.1, Reactor/Auxiliary Building and Primary Containment as structural components in the reactor building. Nonsafety-related FPCCS components that form part of the secondary containment pressure boundary are reviewed in Section 2.3.2.6, Containment Penetrations. Nonsafety-related FPCCS components not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining FPCCS system components are reviewed as listed below as are the fuel storage racks.

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 drawing.

LRA-M-2048

Table 2.3.3-4
Fuel Pool Cooling and Cleanup System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Neutron absorber	Neutron absorption
Piping	Pressure boundary
Rack	Support for Criterion (a)(1) equipment
Valve body	Pressure boundary

2.3.3.5 Emergency Equipment Cooling Water

System Description

The purpose of the emergency equipment cooling water (EECW) system (system code P44) is to supply cooling water to ESF equipment and other equipment required for a safe shutdown of the reactor. The EECW system consists of two cooling water flow trains, Division I and Division II, supplying cooling water to safety-related and select nonsafety-related equipment. Each division can be supplied with cooling water from a circulating EECW pump and EECW heat exchanger, or from the RBCCW pumps and RBCCW heat exchangers.

Normally, the nonsafety-related RBCCW system supplies cooling water to both safety-related and nonsafety-related components supplied by the EECW piping system. Under normal operating conditions, the EECW pumps and heat exchangers are in standby mode.

When required, RBCCW is isolated, and cooling water is supplied to essential loads by the EECW pumps and heat exchangers. Heat from the cooled equipment is rejected to the EESW system via the EECW heat exchanger. Each EECW division includes a makeup tank that provides a surge volume for the EECW pumps. The EECW makeup tanks are supplied with demineralized water during normal plant operation. The EECW system makeup tanks are supplied from the EESW system, via a crosstie line and divisional EECW makeup pump, to provide an alternate makeup supply if the normal makeup supply to the tank is lost.

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

- Supply cooling water to ESF equipment and other equipment required for a safe shutdown of the reactor.
- Support primary containment pressure boundary.

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

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

UFSAR References

Section 1.2.2.9.21

Section 7.1.2.1.18

Section 9.2.2

Components Subject to Aging Management Review

EECW system components that are part of the EESW system pressure boundary are reviewed in Section 2.3.3.3, Service Water. EECW system components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining ECCW system 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-M-2015	LRA-M-4127	LRA-M-4325
LRA-M-2083	LRA-M-5357	
LRA-M-2084	LRA-M-5444	

Table 2.3.3-5
Emergency Equipment Cooling Water System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Flex connection	Pressure boundary
Flow element	Flow control Pressure boundary
Heat exchanger (end cover)	Pressure boundary
Heat exchanger (plates)	Heat transfer Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.6 Compressed Air

System Description

Three Fermi 2 systems include components addressed in this review:

- System code P50 includes the station air, control air and emergency breathing air systems.
- System code T22, the reactor/auxiliary building superstructure, includes compressed air components supporting the reactor building railroad airlock doors.
- System code T49, the primary containment pneumatics system, includes both compressed air and compressed nitrogen components evaluated in this review.

Station Air, Control Air, Emergency Breathing Air

The compressed air systems include the station air, control air and emergency breathing air systems (system code P50). The purpose of the station air and control air systems is to provide the plant with a reliable source of clean, dry, oil-free compressed air for plant operation. The station air system provides air for nonessential uses such as routine maintenance operations or in equipment process cycles such as demineralizer backwashing. The control air system supplies air for instrumentation and control applications. The purpose of the emergency breathing air system is to provide breathing air to control room personnel if a potentially hazardous environment exists in the control room.

The station air system consists of three, two-stage, non-lubricated compressors equipped with inlet filter-silencers, intercoolers and aftercoolers. Two air receivers and the station air distribution piping, valves, and fittings complete the station air equipment.

The control air system is divided into two parts: interruptible and non-interruptible. Non-interruptible control air (NIAS) supplies air to safety-related instruments and controls required to effect a safe reactor shutdown and control during long-term recovery. NIAS is supplied through two separate distribution systems, Divisions I and II. All other control air users are supplied by the interruptible control air distribution system.

The NIAS portion of the system consists of two full-capacity single-stage non-lubricated reciprocating air compressors; two full-capacity parallel strings of oil filters, air dryers and afterfilters; two control air receivers; and associated piping, fittings, and valves. During normal plant operation, the source of NIAS is through interconnections with the station air system. Compressed air from the station air system is supplied to the Division I and II non-interruptible control air compressor discharge headers. The air then flows from each header through its divisional full capacity filter and dryer. After the filter/dryer, the non-interruptible control air flows to its divisional control air receiver from which it eventually flows to its point of use through its divisional non-interruptible control air distribution system. An intertie is provided to permit Division I non-interruptible control air to be used as an emergency backup to the Division I containment pneumatic supply system.

Another station air connection supplies the interruptible control air system through two full capacity redundant dryers. Each dryer has its own prefilter, afterfilter and instrumentation. The dryer units feed a common air receiver. The interruptible control air system supplies both safety-related and nonsafety-related equipment. Safety-related components supplied by the interruptible control air system either fail in a safe position or are equipped with air accumulators with sufficient capacity to support the safety function of the supplied component.

The emergency breathing air system consists of stationary air cylinders, associated piping, and a manifold station. The manifold, located inside the control room, feeds five hose-line air masks.

The station air, control air and emergency breathing air systems have the following intended functions for 10 CFR 54.4(a)(1).

- Provide clean, dry, oil-free compressed air for safety-related instrumentation and controls located throughout the plant.
- Provide sufficient air storage by safety-related accumulators to supply essential equipment (normally served by IAS) during and following a postulated LOCA.
- Provide an emergency backup to the Division I containment pneumatic supply system.
- Provide an emergency source of breathing air for control room personnel use.

The station air, control air and emergency breathing air systems have 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 station air, control air and emergency breathing air systems have the following intended function for 10 CFR 54.4(a)(3).

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

Reactor/Auxiliary Building

The purpose of the reactor/auxiliary building is to house and protect the reactor and its supporting engineered safety features and auxiliary systems. The reactor building also provides secondary containment during normal operation. Additional details of the reactor/auxiliary building are provided in Section 2.4.1, Reactor/Auxiliary Building and Primary Containment. The reactor/auxiliary building substructure and superstructure system codes, T21 and T22 respectively, include various mechanical, electrical and structural components and equipment that are related to or form part of the reactor/auxiliary building.

The reactor/auxiliary building superstructure system code, T22, includes safety-related mechanical components that support the operation of the reactor building railroad airlock doors. These doors form part of the secondary containment pressure boundary.

The reactor/auxiliary building systems have the following intended function for 10 CFR 54.4(a)(1).

- Support the secondary containment pressure boundary.

The reactor/auxiliary building systems have 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 reactor/auxiliary building systems have no intended functions for 10 CFR 54.4(a)(3).

Primary Containment Pneumatics

The purpose of the primary containment pneumatics (PCP) system (system code T49) is to provide pneumatic pressure for the activation of safety-related valves and other equipment inside the drywell. Supplied equipment includes nuclear pressure relief valves, containment isolation valves, testable/exercisable check valves, and the traversing incore probe purge valve assembly and indexing mechanism.

The PCP system consists of a piping system which conveys pressurized gas (nitrogen or air) from one of several sources located outside of the primary containment to its end users. The system is separated into two independent supply headers, Division I and II. The normal supply of pneumatic pressure for the PCP system is the nitrogen inerting system when the primary containment is inerted. The NIAS feeds the Division I PCP system header when the containment is de-inerted. In the event of failure of the nitrogen inerting system while the primary containment is inerted, the NIAS system can be used as the backup source of pneumatic supply to the Division I header. The Division II header is not supplied by the NIAS. Both the Division I and II PCP system headers can also be supplied with pressurized nitrogen from separate bottle stations located outside the reactor building.

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

- Provide pneumatic pressure for the activation of safety-related equipment.
- Support primary containment pressure boundary.

The PCP 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 PCP 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).

UFSAR References

Station Air, Control Air and Emergency Breathing Air

Section 6.4.2.5	Section 7.6.1.17
Section 7.1.2.1.32	Section 9.3.1

Reactor/Auxiliary Building

Section 6.2.1.2.2

Primary Containment Pneumatics

Section 5.2.2.2

Section 9.3.1

Section 9.3.6

Nonsafety-related components of these systems not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining compressed air system 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-I-2649-1	LRA-M-2083	LRA-M-3445-1
LRA-I-2679-01	LRA-M-2084	LRA-M-4615
LRA-M-2015	LRA-M-2085	LRA-M-5007
LRA-M-2035	LRA-M-2089	LRA-M-5357
LRA-M-2043	LRA-M-2709	LRA-M-5444
LRA-M-2044	LRA-M-2833	LRA-M-5730-7
LRA-M-2045	LRA-M-3045	LRA-SD-2541-02B

Table 2.3.3-6
Compressed Air Systems
Components Subject to Aging Management Review

Component Type	Intended Function
Accumulator	Pressure boundary
Bolting	Pressure boundary
Chamber	Pressure boundary
Condenser	Pressure boundary
Dryer	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Flow element	Flow control Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Manifold	Pressure boundary
Moisture separator	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Regulator	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary

**Table 2.3.3-6 (Continued)
Compressed Air Systems
Components Subject to Aging Management Review**

Component Type	Intended Function
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.7 Fire Protection – Water

System Description

The purpose of the fire protection system is to provide fire protection for all potential fire hazards. It provides prompt fire detection, alarm, and suppression. Included in the fire protection system are a fire protection water supply and distribution system, fixed water spray and automatic sprinkler systems, gaseous extinguishing systems, and a fire detection and alarm system. Mechanical components of the fire protection system are included in the following system codes:

- P80 - Fire protection
- T80 - Reactor building fire protection
- U80 - Turbine building fire protection
- V80 - Radwaste building fire protection
- X80 - RHR complex fire protection

The fire protection system is reviewed as fire protection – water (this section) and fire protection – carbon dioxide and Halon (Section 2.3.3.8). The review of fire protection – water includes components from the general service water (GSW) biocide injection system (system code P27).

The water-based fire protection consists of manually operated hose stations and fire hydrants and manual and automatic sprinkler and water spray systems. All of these are supplied with water from an underground distribution loop which surrounds the Fermi 2 plant. Branch connections from the loop supply standpipes and hose stations, fire hydrants, and sprinkler and water spray systems that are inside and outside of the protected area. The fire protection water system supplies fire hydrants adjacent to the Fermi 1 decommissioned unit.

The normal source of water to the fire water distribution loop is from the GSW system via a jockey pump. This jockey pump takes suction from the GSW pump discharge header and pressurizes the fire protection water distribution loop. There are two fire water pumps located in the general service water pump house (one motor driven and one engine driven), which automatically supply water directly from Lake Erie if fire water loop pressure drops below preset limits.

Hose stations are located inside buildings and structures, and hydrants are located outside buildings and structures to manually combat fires. Hose houses with various combinations of hose sizes and lengths are provided for some hydrants.

Automatic sprinkler systems protect structures and equipment throughout the plant. Wet-pipe sprinkler, dry-pipe sprinkler, deluge spray systems with open spray nozzles, pre-action sprinkler systems with fusible heads, and deluge spray systems with fusible heads are provided within the plant. Manually actuated sprinkler systems are used in a limited number of locations.

The control center HVAC makeup filter and recirculation filter charcoal adsorber units are each provided with water spray protection supplied from the fire water system. This protection is manually isolated by locked closed isolation valves to each absorber unit. If required, the isolation valves are manually opened to initiate water flow. The isolation valves to the control center HVAC equipment form part of the safety-related pressure boundary of that system.

The fire protection – water system has the following intended function for 10 CFR 54.4(a)(1).

- Support the safety-related pressure boundary of the control center HVAC system.

The fire protection – water 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 fire protection – water 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).

GSW Biocide Injection

The purpose of the GSW biocide injection system (system code P27) is to treat the GSW system with a biocide to inhibit slime and algae growth and to control organic and inorganic fouling of heat exchanger and piping surfaces. The nonsafety-related system includes eductors, metering pumps, diffusers, strainers, tank, piping, and valves. System components are located in the GSW pump house.

Service water provided by the GSW system goes through injection eductors, where it is mixed with sodium hypochlorite from the storage tank. The flow path ends with diffusers in the GSW pump pits. Injection metering pumps are also available. Besides the GSW pump pits, biocide may also be provided to GSW system piping at two injection points on the supply header. Biocide is also provided to the fire water system through a single isolation valve, which provides a pressure boundary function.

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

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

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

UFSAR References

Section 9.5.1

Section 9.2.1 (GSW biocide injection)

Components Subject to Aging Management Review

Although the hose stations for the fire protection – water system have a pressure boundary function, only the hose supply valves and piping components are subject to aging management review. Fire hoses are not subject to aging management since they are periodically inspected, hydro tested, and replaced as necessary.

The hose reels required for fire protection (10 CFR 50.48) are addressed in the review of bulk structural commodities in Section 2.4.4 as are fire barriers, fire doors, fire dampers mounted in walls, and other structural components required for fire protection (10 CFR 50.48). Fire damper housings mounted in ductwork required for compliance with 10 CFR 50.48 are addressed in Section 2.3.3.11, Heating, Ventilation and Air Conditioning. Fuel oil components of the diesel-driven fire pump are reviewed in Section 2.3.3.15, Fuel Oil. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining fire protection – water system 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-M-2010	LRA-M-N-2050
LRA-M-2135	LRA-M-N-2051
LRA-M-2135-1	

Table 2.3.3-7
Fire Protection – Water System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Flex connection	Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Hydrants	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Screen	Filtration
Silencer	Pressure boundary
Sprinkler	Flow control Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.8 Fire Protection – Carbon Dioxide and Halon

System Description

The purpose of the fire protection system is to provide fire protection for all potential fire hazards. It provides prompt fire detection, alarm, and suppression. Included in the fire protection system are a fire protection water supply and distribution system, fixed water spray and automatic sprinkler systems, gaseous extinguishing systems, and a fire detection and alarm system. Mechanical components of the fire protection system are included in the following system codes:

- P80 - Fire Protection
- T80 - Reactor Building Fire Protection
- U80 - Turbine Building Fire Protection
- V80 - Radwaste Building Fire Protection
- X80 - RHR Complex Fire Protection

The fire protection system is reviewed as fire protection – carbon dioxide (CO_2) and Halon (this section) and fire protection – water (Section 2.3.3.7).

The gaseous based fire protection consists of CO_2 and Halon 1301 (Halon) suppression systems and manually operated CO_2 hose stations.

CO_2 suppression systems protect the emergency diesel generators (EDGs) in the RHR complex and areas in the auxiliary building. All of the systems normally operate fully charged up to a closed master valve. Separate CO_2 storage units supply each set of EDG suppression systems. A common CO_2 storage unit supplies the auxiliary building suppression systems and hose stations. Manual CO_2 hose stations are located in the auxiliary building inside the Division II switchgear room, outside the relay room, and outside the Division I switchgear room.

Halon suppression systems protect areas located in the auxiliary and service buildings, guard house, and office building annex. All of the systems normally operate fully charged up to an automatic discharge valve, which is closed. A primary and reserve storage unit is provided for each area protected except in the office building annex, which has a primary storage unit only.

Hand-held fire extinguishing devices are located inside designated Fermi 2 buildings in normally accessible areas. These devices are of sufficient quantity and type (CO_2, dry chemical, water and Halon) to manually combat anticipated fires.

The fire protection – CO_2 and Halon system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The fire protection – CO_2 and 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).

UFSAR References

Section 9.5.1

Components Subject to Aging Management Review

Portable fire extinguishers, fire hoses and air packs (self-contained breathing apparatus) have been provided throughout the plant in accordance with the requirements of the NFPA standards. Portable extinguishers, fire hoses and air packs are not subject to aging management review since they are replaced based on performance and condition monitoring.

Although the hose stations for the CO_2 system have a pressure boundary function, only the hose supply valves and piping components are subject to aging management review. The hoses are not subject to aging management since they are periodically inspected, hydro tested, and replaced as necessary. The hose reels required for fire protection (10 CFR 50.48) are addressed in the review of bulk structural commodites in Section 2.4.4.

Remaining CO_2 and halon 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-M-N-2051	LRA-M-2709
LRA-I-2649-1	LRA-M-4548

Table 2.3.3-8
Fire Protection – Carbon Dioxide and Halon System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Flex connection	Pressure boundary
Heat exchanger (tubes)	Pressure boundary
Nozzle	Flow control Pressure boundary
Odorizer	Pressure boundary
Piping	Pressure boundary
Sight glass	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.9 Combustion Turbine Generator

System Description

The purpose of the auxiliary electrical peaker combustion turbine generator (CTG) system (system code R11) is to provide an independent source of electrical power. The CTG system is used as an alternate source of power for station blackout and for safe shutdown following a fire as part of the alternate shutdown system. The CTG system includes four oil-fired turbine generators, fuel oil storage tanks, a starting diesel for CTG 11-1, a standby diesel generator used to start CTG 11-2, 11-3 and 11-4, and associated support equipment, instruments and controls. The CTGs are located on the Fermi 1 site.

CTG 11-1 is black start capable. CTG 11-1 is started by a diesel-driven starting engine connected directly to the CTG 11-1 turbine, and is controlled and started from the CTG 11-1 battery. CTG 11-1 is used as the alternate AC source for a station blackout event and to support response by the dedicated shutdown panel to an Appendix R fire.

CTG 11-2, 11-3 or 11-4, started with the standby diesel generator, can also be utilized as an alternate source of ac power; however, these alternate CTG units are not credited for station blackout or for Appendix R safe shutdown.

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

The CTG 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).

UFSAR References

Section 7.5.2.5.2	Section 9A.4.7.11.2
Section 8.2.1.2	Section 9A.4.7.9.1
Section 8.4	

Components Subject to Aging Management Review

Components of the fuel oil supply to the CTGs and their supporting diesels are evaluated in Section 2.3.3.15, Fuel Oil. Remaining CTG system components are reviewed as listed below.

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

No license renewal drawings are provided for the CTG system.

Table 2.3.3-9
Combustion Turbine Generator System
Components Subject to Aging Management Review

Component Type	Intended Function
Accumulator	Pressure boundary
Annulus	Pressure boundary
Assembly	Pressure boundary
Bellows	Pressure boundary
Bolting	Pressure boundary
Cover	Pressure boundary
Damper	Pressure boundary
Duct	Pressure boundary
Ejector	Pressure boundary
Filter	Filtration
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Hood	Pressure boundary
Housing	Pressure boundary
Liner	Flow control Pressure boundary
Nozzle	Pressure boundary
Orifice	Flow control Pressure boundary

Table 2.3.3-9 (Continued)
Combustion Turbine Generator System
Components Subject to Aging Management Review

Component Type	Intended Function
Piping	Pressure boundary
Plenum	Pressure boundary
Pump casing	Pressure boundary
Screen	Filtration
Separator	Pressure boundary
Silencer	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tube	Pressure boundary
Tubing	Pressure boundary
Turbine casing	Pressure boundary
Turbocharger	Pressure boundary
Valve body	Pressure boundary

2.3.3.10 Emergency Diesel Generator

System Description

The purpose of the emergency diesel generator (EDG) system (system code R30) is to provide power, in the event of a loss of offsite power, to the engineered safety features (ESF) electrical loads for safe reactor shutdown and to mitigate the consequences of a design basis accident such as a LOCA. Standby AC power is supplied by four diesel generators. Each division is supplied by two diesel generators.

The diesel generator starts automatically on loss of voltage to its respective bus or following a LOCA indicated by low reactor water level or high drywell pressure. If offsite power to the ESF bus is degraded or lost, the corresponding diesel generator automatically operates as an isolated source of electrical power and sequences the ESF loads necessary to mitigate the consequences of an accident. All EDGs start on low reactor water level or high drywell pressure LOCA signal. However, if the ESS bus voltage is normal during a LOCA, the diesel generators will idle at synchronous speed and rated voltage with the EDG output breakers open.

The EDG system includes the diesel generators and the supporting subsystems for the diesels. Each of the EDG units is a turbocharged 12-cylinder, opposed piston, 3967 hp, 900 rpm diesel driving one 4160-V AC, salient pole generator using a solid-state excitation system and a fast-response electrohydraulic governor. Each EDG unit is rated for a continuous electric capacity of 2850 kW. Each EDG unit is housed in its own room in the RHR complex. The supporting subsystems include fuel oil, air start, service water, jacket cooling water, lubricating oil, and combustion air and exhaust.

Fuel Oil

The EDG fuel oil system is described in Section 2.3.3.15, Fuel Oil.

Air Start

A complete air-operated starting system is furnished for each EDG. The starting system is of the air-over-piston type supplied from two accumulators. Two accumulators and two starting solenoid valves are furnished for each unit. One motor-driven air compressor is furnished for each EDG to recharge the accumulators to normal operating pressure when required. A refrigerated air dryer is provided between the compressors and the receivers to ensure that the air supplied is adequately dehumidified. Piping is provided to cross-connect the EDG air compressors so that one EDG's air compressor can charge the air receiver for both EDGs within a division.

Service Water

The diesel generator service water system provides a cooling water source for the EDGs during testing and emergency operation. Diesel generator cooling water is supplied from the RHR reservoirs with each diesel generator supplied by its own pump. Supply lines are also independent for each diesel generator. The diesel generator service water pumps start and stop automatically in conjunction with the diesel generators. The diesel generator service water supplies cooling water to the lube oil heat exchanger, the engine air coolant heat exchanger, and the engine jacket coolant heat exchanger.

Jacket Coolant System

Each diesel generator is provided with a jacket coolant system. The EDG jacket cooling water system is a closed loop system that removes heat from the engine and transfers it to the EDG service water system. It also maintains the jacket coolant system water warm in standby mode to ensure quick start. Major components of the system include an expansion tank, jacket coolant pump, standby coolant circulating pump, heat exchanger, standby heater, and the associated piping, valves, and controls. The engine-driven coolant pump maintains coolant circulation in the closed loop during diesel generator operation. The expansion tank accommodates the volume changes in the coolant due to temperature changes and also provides a means for venting the system. The heat removed by the coolant from the engine is transferred to the diesel generator service water through a heat exchanger.

The jacket coolant also cools the intake combustion air in a separate subloop of the engine jacket coolant system. This closed loop system has an engine-driven coolant pump, air coolers, air coolant heat exchanger, and control valve.

Lubricating Oil

The diesel generator lubrication system is an integral part of each diesel generator. The EDG lube oil system lubricates and cools the engine during operation and keeps the lube oil warm in standby mode to ensure a quick start. Major components of the system include a lube oil tank, lube oil pump, lube oil circulation pump and heaters, filter, heat exchanger, strainer, prelube pump, and the associated piping, valves, and controls. The lube oil flows by gravity from the lube oil tank to the sump located at the base of the engine. The engine-driven lube oil pump takes oil from the sump through a suction strainer and passes it through a filter. Depending on the oil temperature, the lube oil is directed through or around the lube-oil heat exchanger. The lube oil is cooled by the diesel generator service water system, which flows through the tubes of the lube oil heat exchanger. Before being delivered to the engine, the lube oil passes through a strainer. A motor-driven prelube pump, which can be manually operated from the remote panel, is provided for prelubricating the engine prior to nonemergency starts.

Combustion Air and Exhaust

The combustion air system supplies the combustion air from the outside of the building to the diesel engine turbocharger and provides required filtration and silencing. The air coolant subloop of the jacket coolant system cools inlet combustion air during EDG operation and transfers heat to the EDG service water system. The exhaust system drives the turbochargers and exhausts the engine gases to the outside of the building and silences noise as required.

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

- Provide power, in the event of a loss of offsite power, to the ESF electrical loads for safe reactor shutdown and to mitigate the consequences of a design basis accident.

The EDG 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 EDG 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).

UFSAR References

Section 8.3.1.1.8	Section 9.5.5
Section 9.2.5.2.3	Section 9.5.6
Section 9.5.4	Section 9.5.7

Components Subject to Aging Management Review

Components of the EDG fuel oil system are reviewed in Section 2.3.3.15, Fuel Oil. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining EDG system components 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-M-N-2046	LRA-M-N-2049
LRA-M-N-2047	LRA-M-N-2052
LRA-M-N-2048	LRA-M-N-2053

**Table 2.3.3-10
Emergency Diesel Generator System
Components Subject to Aging Management Review**

Component Type	Intended Function
Blower housing	Pressure boundary
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Filter housing	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (housing)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Muffler	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Silencer	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary

Table 2.3.3-10 (Continued)
Emergency Diesel Generator System
Components Subject to Aging Management Review

Component Type	Intended Function
Turbocharger	Pressure boundary
Valve body	Pressure boundary

2.3.3.11 Heating, Ventilation and Air Conditioning

System Description

The HVAC components at Fermi 2 are divided into separate system codes and are therefore discussed in separate sections below. The separate systems are the dedicated shutdown system, the reactor/auxiliary building ventilation systems, the primary containment atmosphere cooling system, and the RHR complex and office service building HVAC system.

Dedicated Shutdown

The purpose of the dedicated shutdown system (system code C36), as part of the alternate shutdown system, is to provide a means to cool down and depressurize the reactor should a fire occur in certain areas of the auxiliary building or the control center complex. The dedicated shutdown system provides a dedicated shutdown panel located in the second floor of the radwaste building from which an operator can monitor the reactor and keep the reactor core covered with water.

The system is primarily an electrical system, with control and transfer switches which permit use of appropriate plant systems from the remote control panel. However, the system also includes a small number of mechanical components. The system includes safety-related valves associated with suppression pool level indication that support the pressure boundary of the suppression pool.

The system also includes a dedicated shutdown air conditioning unit installed in the radwaste building to provide cooling, if needed, to maintain habitability at the dedicated shutdown panel location. The dedicated shutdown air conditioning unit is a split system with the air handling unit located inside the room and outside condensing unit located on the adjacent roof. The air handling unit includes a filter, fan, two evaporator-type cooling coils, and condensate collection equipment. The condensing unit includes two compressor/condenser refrigerant circuits.

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

- Support the suppression pool pressure boundary.

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

The dedicated shutdown 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).

Reactor/Auxiliary Building Ventilation

The purpose of the reactor/auxiliary building HVAC systems (system code T41) is to provide the required ambient environment for plant equipment, to provide a comfortable working environment for plant personnel, and to control airborne radioactivity. System code T41 consists of various reactor and auxiliary building HVAC systems and portions of the plant heating system that serve the reactor and auxiliary buildings. The HVAC systems included in system code T41 are the reactor/auxiliary building ventilation system, the steam tunnel cooling system, the motor-generator set cooling system, and the control center HVAC, which is reviewed in Section 2.3.3.12, Control Center Heating, Ventilation and Air Conditioning.

Reactor/Auxiliary Building Ventilation

The reactor/auxiliary building ventilation system is a once-through system with no recirculation of air. The system supplies filtered outside air to accessible areas of the reactor and auxiliary buildings through a central fan system. The system maintains an airflow from general access areas of low potential radioactive airborne contamination to areas of progressively higher potential contamination to control the spread of contamination within the building. The ventilation air is exhausted from areas of high potential contamination through a common vent located on top of the auxiliary building. The system includes three half-capacity supply fans, three half-capacity exhaust fans, an outside air intake, filters, heating coils, and associated dampers (including fire dampers), ductwork, instruments and controls.

General cooling is provided by the once-through ventilation air. There are no cooling coils in the ventilation air supply. Fan-coil-cooling units (space coolers) are located throughout the reactor building to cool ESF equipment. The space coolers maintain the temperature of the ESF equipment at or below design thermal limits whenever the once-through ventilation air is unable to maintain the designed room temperatures, including when the secondary containment is isolated. Cooling water is normally supplied to the fan-coil units by the RBCCW system. During malfunction of the RBCCW system or on loss of offsite power, cooling water is supplied by the EECW system.

To support secondary containment isolation, two isolation dampers are provided in each supply and exhaust duct that penetrates the reactor building. These dampers are closed when there is high radioactivity in the reactor building, high drywell pressure, low reactor water level, or loss of offsite power. When the reactor building is isolated, the ventilation supply and exhaust fans are stopped and the reactor building is maintained under negative pressure by the SGTS.

Each ESF battery room is equipped with two full-capacity exhaust fans to maintain a non-explosive atmosphere by dispersing hydrogen throughout the auxiliary building.

The exhaust fan is started on a loss of airflow from the ESF battery room air conditioning system or loss of offsite power.

The reactor and auxiliary buildings are heated with steam supplied by the auxiliary boiler system. Steam heating coils are located in the ventilation air intake upstream of the supply fans. Additional heating is provided throughout the building with local steam unit heaters. Isolation valves in the heating steam piping at the secondary containment boundary allow isolation of the steam piping in the event of a postulated break in the heating steam piping.

The reactor/auxiliary building ventilation system has the following intended functions for 10 CFR 54.4(a)(1).

- Provide cooling to maintain ESF equipment within design limits.
- Support secondary containment pressure boundary.
- Prevent the buildup of hydrogen in the ESF battery rooms.
- Provide isolation capability of a plant heating steam line break.

The reactor/auxiliary building ventilation 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 reactor/auxiliary building ventilation 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).

Steam Tunnel Cooling

The steam tunnel is cooled by non-ESF space coolers located in the steam tunnel to limit the steam tunnel temperature during normal operation to allow personnel access and prolong equipment life. The steam tunnel cooling system consists of two full-capacity cooling coils and fans connected to a common supply plenum. The supply ducts from the plenum deliver the cooled air to various areas within the tunnel. The air is returned to the cooling coils by the induced draft of the fan. Cooling water is supplied to the cooling coils by the RBCCW system.

The steam tunnel cooling system has no intended functions for 10 CFR 54.4(a)(1).

The steam tunnel cooling 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 steam tunnel cooling system has no intended functions for 10 CFR 54.4(a)(3).

Motor-Generator Set Cooling

The motor-generator (M-G) set cooling system provides cooling air to the reactor recirculating pump M-G sets during normal operation to prolong the life of the equipment. Non-ESF fan-coil cooling units induce room air to flow through each generator and motor. The air is then drawn through a common exhaust duct system to the fan-coil units. The fan-coil units cool the air and discharge to the room. The cooling coils are cooled by the RBCCW system.

The M-G set cooling system has no intended functions for 10 CFR 54.4(a)(1).

The M-G set cooling 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 M-G set cooling system has no intended functions for 10 CFR 54.4(a)(3).

<u>Primary Containment Atmosphere Cooling</u>

The purpose of the primary containment atmosphere cooling (PCAC) system (system code T47) is to maintain the temperature of the drywell atmosphere within design conditions. (UFSAR Section 9.4.5 refers to this system as the drywell cooling system.) The system recirculates drywell air through fan-coil units to limit the maximum drywell temperature. The system uses air-to-water cooling coils with water supplied by the RBCCW system during normal operating conditions and by the EECW system during abnormal conditions.

The cooling system consists of 14 fan-coil coolers in two divisions, each consisting of five single-speed and two two-speed coolers. Each unit is furnished with cooling coils, supply air fan, distribution ductwork, air-diffusing devices, and controls.

The PCAC system is not credited for post-accident cooling. The cooling coils form part of the safety-related EECW system pressure boundary. The system has no other safety function.

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

- Support the EECW system pressure boundary.

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

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

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

RHR Complex and Office Service Building HVAC

The purpose of the RHR complex and office service building (OSB) HVAC system (system code X41) is to provide the required ambient environment for plant equipment and a comfortable working environment for plant personnel. System code X41 includes HVAC equipment for the RHR complex, the OSB, and other site structures, including the auxiliary boiler house (ABH) and GSW pump house.

RHR complex HVAC subsystems provide ventilation for the emergency diesel generator rooms, RHR complex switchgear rooms, diesel fuel oil storage rooms, and RHR complex pump rooms. These subsystems include fans, filters, ducts and dampers (including fire dampers), electric heaters, instruments and controls. The subsystems use electric heaters and outdoor air as needed to maintain appropriate room temperatures for the equipment.

The OSB HVAC equipment maintains a comfortable working environment for plant personnel and supports various air conditioning and cooling requirements throughout the OSB. The OSB houses no safety-related equipment, and the OSB HVAC equipment supports no safety function.

The ABH HVAC equipment uses outdoor air and electric heat to maintain an acceptable environment for the operation of the auxiliary boiler. The ABH houses no safety-related equipment, and the ABH HVAC equipment supports no safety function.

The GSW pump house HVAC equipment uses outdoor air and electric heat to maintain the temperature in the pump and switchgear rooms. The GSW pump house contains no safety-related equipment, and the GSW pump house HVAC equipment supports no safety function.

The RHR complex and OSB HVAC system has the following intended function for 10 CFR 54.4(a)(1).

- Maintain appropriate room temperatures for the equipment in the RHR complex.

The RHR complex and OSB HVAC 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 RHR complex and OSB HVAC system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function (HVAC provides fire dampers and safe shutdown support) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

UFSAR References

Dedicated Shutdown

Section 7.5.2.5
Section 9.4.3.2

PCAC

Section 1.2.2.15.18
Section 9.4.5

RHR Complex and OSB HVAC

Section 9.3.3
Section 9.4.7
Section 9.4.9

Reactor/Auxiliary Building HVAC

Section 1.2.2.15.4
Section 9.4.2
Section 9.4.8

Steam Tunnel Cooling System

Section 9.4.6

Motor-Generator Set Cooling System

Section 9.4.11

Components Subject to Aging Management Review

Components of the dedicated shutdown system supporting the suppression pool (primary containment) pressure boundary are reviewed in Section 2.3.2.6, Containment Penetrations. System components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. Components supporting the EECW system pressure boundary are reviewed in Section 2.3.3.5, Emergency Equipment Cooling Water. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining HVAC 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-M-N-2056	LRA-M-2240	LRA-M-4127
LRA-M-N-2057	LRA-M-2271	LRA-M-5357
LRA-M-N-2058	LRA-M-2707	LRA-M-5444
LRA-M-N-2059	LRA-M-2707-1	

Table 2.3.3-11
Heating, Ventilation and Air Conditioning System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Condenser housing	Pressure boundary
Cooler housing	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (housing)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.12 Control Center Heating, Ventilation and Air Conditioning

System Description

The purpose of the control center heating, ventilating, and air conditioning (CCHVAC) system (system code T41) is to provide ventilation, heating, and cooling, and to limit the relative humidity in the control center envelope during normal operation and following an accident. (UFSAR Sections 6.4 and 9.4.1 refer to the system as the control center air conditioning system.) The control center envelope includes the main control room, office and conference room, and the cable spreading room, relay room, computer room and mechanical equipment rooms. The standby gas treatment rooms are included in the envelope during normal operation but are isolated from the envelope during emergency modes.

Major components of the CCHVAC include two multizone air-conditioning units, two return air fans, two chiller units, one emergency makeup air filter unit, and a recirculation filter train with filters and two fans. The system also includes two mechanical equipment room fan coil units, two computer room fan coil units, a toilet exhaust fan, a kitchen exhaust fan, and a cable tray cooling fan. Supply, return, intake (normal and emergency) and exhaust ductwork, and associated dampers (including fire dampers), piping, valves, instruments, and controls are also included.

The system has four modes of operation: normal, purge, recirculation and chlorine.

Normal Mode

In the normal mode of operation, outside air from the normal makeup air intake mixes with recirculated (return) ventilating air, bypassing the emergency makeup and recirculation filters. The mixture of return and outside air is filtered, then cooled, heated, and dehumidified, as required, by a multizone air conditioning supply unit. The air is distributed throughout the control center envelope. Return air from the control center is drawn through the return fan and is either recirculated back to the multizone air handling unit or exhausted from the building through the normal exhaust pressure control damper. Positive pressure is maintained in the control center by throttling the normal exhaust pressure control damper.

Purge Mode

In the purge mode, recirculation flow is suspended and outside air is circulated through the control center and exhausted to the atmosphere to purge any smoke or fumes within the control center. The CCHVAC system is realigned to isolate the return air process stream by closing the return damper and maximize the use of outside ventilation air by fully opening the normal intake and exhaust dampers.

Recirculation Mode

In the recirculation mode, the normal air intake and exhaust is isolated and air is supplied from one of the emergency air intakes through the emergency makeup air filters. The filtered outside air is mixed with a portion of the recirculated air that is filtered again and mixed with the remaining recirculating ventilation air to prevent intrusion and to provide continuous removal of contaminants during a radiation-release emergency. In this mode, the control center is isolated from all other areas of the plant, and a positive pressure is maintained in the control center. Air supplies to the standby gas treatment rooms are closed, and the kitchen and washroom exhaust ducts are isolated.

Chlorine Mode

In the chlorine mode, all outside intakes are closed to prevent ingress during a chlorine-release emergency. Ventilating air is recirculated with a portion passing through the recirculation filter.

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

- Maintain the control center environment to support continued operation of safety-related equipment and operator habitability following a design basis accident.
- Limit the introduction of airborne radioactivity into the control room, and remove airborne radioactivity from the control room environment.
- Limit the introduction of chlorine gas into the control room.

The CCHVAC 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 CCHVAC 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).

UFSAR References

Section 1.2.2.9.24

Section 6.4

Section 9.4.1

Components Subject to Aging Management Review

Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining CCHVAC system components 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-M-2751	LRA-M-4325
LRA-M-2847	LRA-I-2181-04

Table 2.3.3-12
Control Center HVAC System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Compressor housing	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Flow element	Flow control Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (housing)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Moisture separator	Filtration
Piping	Pressure boundary
Pump casing	Pressure boundary
Rupture disc	Pressure boundary
Sight glass	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary

**Table 2.3.3-12 (Continued)
Control Center HVAC System
Components Subject to Aging Management Review**

Component Type	Intended Function
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.13 Containment Atmospheric Control

System Description

The purpose of the containment atmospheric control system (system code T48) is to control the concentration of hydrogen and oxygen inside primary containment below combustible levels. Combustible gas control of the primary containment is provided by two separate subsystems: the nitrogen inerting system and the post-LOCA combustible gas control system. The nitrogen inerting system reduces oxygen inside the primary containment during normal operation by creating and maintaining a nitrogen atmosphere. The post-LOCA combustible gas control (or post-LOCA hydrogen control) system may be used to limit the hydrogen and oxygen created following an accident by means of thermal recombination.

The nitrogen inerting system provides and maintains a nitrogen atmosphere inside the primary containment. Nitrogen gas is injected into the primary containment and the existing atmosphere is displaced through the reactor/auxiliary building ventilation system or through the standby gas treatment system. The nitrogen inerting system also provides pressurized nitrogen for pneumatic service inside the primary containment and distribution throughout the plant. (See Section 2.3.3.6, Compressed Air, for a description of the primary containment pneumatics system, system code T49.)

The supply portion of the nitrogen inerting system includes a vendor owned and operated nitrogen supply station, a steam vaporizer, electric heat exchanger, nitrogen receivers, piping, valves, instruments, and controls. The safety-related portions of the nitrogen inerting system include primary containment penetrations and associated isolation valves used for inerting the primary containment and to supply pneumatically controlled valves inside the primary containment. Nonsafety-related piping and valves of the nitrogen supply also support the secondary containment pressure boundary.

The post-LOCA combustible gas control system consists of two thermal hydrogen recombiners. The recombiners are skid mounted units located in the reactor building and connected to the primary containment by piping and isolation valves. Each recombiner skid is a welded steel and stainless-steel gas containment system consisting of the inlet piping, flow meters, flow control valves and enclosed blower assembly, heater section, reaction chamber, direct contact water spray gas cooler, water separator, and the return piping. License Amendment 159 removed the hydrogen recombiner Technical Specification requirements; however, the hydrogen recombiners are still classified as safety-related. Although hydrogen recombination is no longer considered a safety function, the recombiner components still form a closed system that is part of the containment pressure boundary.

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

- Support primary containment pressure boundary.

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

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

The containment atmospheric control system has no intended functions for 10 CFR 54.4(a)(3).

UFSAR References

Section 1.2.2.9.22

Section 6.2.5

Section 9.3.6

Components Subject to Aging Management Review

Recombiner water supply components from the RHR system are reviewed in Section 2.3.2.2, Residual Heat Removal. One drywell exhaust isolation valve is reviewed in Section 2.3.2.7, Standby Gas Treatment. Components that support the secondary containment pressure boundary are reviewed in Section 2.3.2.6, Containment Penetrations. System components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining containment atmospheric control 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 drawings.

LRA-M-2087	LRA-M-3445-1
LRA-M-2709	LRA-I-2679-01

**Table 2.3.3-13
Containment Atmospheric Control System
Components Subject to Aging Management Review**

Component Type	Intended Function
Blower housing	Pressure boundary
Bolting	Pressure boundary
Chamber	Pressure boundary
Cooler	Pressure boundary
Flow element	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Separator	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.14 Plant Drains

System Description

Plant drains is the collective name for floor and equipment drains included in this review. This review of plant drains includes components from system code T45, floor and equipment drains; G11, radioactive waste; and X42, RHR complex drains and OSB potable water.

Plant drains components that are included in this review are those that maintain the pressure boundary of the system from the plant floor and equipment drains to the sumps in safety-related areas that prevent potential flooding from fire protection system actuation or use, as discussed in the response to BTP APCSB 9.5-1, position d.1(i).

The failure of fire protection water system piping or the inadvertent operation of the system does not affect the operation of the safety-related systems, as adequate drainage is provided in all buildings to prevent flooding and as all safety-related systems are designed to be protected from water spray and jet forces from the piping in the area. Thus this review only evaluates the floor drains in safety-related areas, taking into consideration that the drain in a given area with the actuation or use of the fire water system is sufficient to route the fire water from the area and collect it in the appropriate sump.

Floor and Equipment Drains

The purpose of the floor and equipment drains system is to collect and remove all waste liquids from their points of origin to a suitable disposal area in a controlled and safe manner. The floor and equipment drains system (system code T45) includes piping components and valves routing floor and equipment drains in the drywell and reactor/auxiliary building to sumps and collection tanks of the radioactive waste system (system code G11). The floor and equipment drains system also includes piping of the turbine building floor and equipment drains. The turbine building floor and equipment drain piping is considered part of system code U45; however, the equipment database includes no components for U45 nor is this system code identified on system drawings. Consequently, the piping is considered part of system code T45 for license renewal.

Nonsafety-related components of the floor and equipment drains system (loop seals) form part of the secondary containment pressure boundary. Primary containment pressure boundary components of the drains systems are part of the radioactive waste system. The floor and equipment drains system has no safety functions.

The floor and equipment drains system has no intended functions for 10 CFR 54.4(a)(1).

The floor and equipment drains system has the following intended functions for 10 CFR 54.4(a)(2).

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

The floor and equipment drains system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function (floor drains prevent flooding from fire protection system) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Radioactive Waste

The radioactive waste system (system code G11) includes the liquid radwaste and solid radwaste systems. The purpose of the liquid radwaste system is to segregate, collect, and process liquid waste generated throughout the plant. The purpose of the solid radwaste system is to handle and package solid waste.

The liquid radwaste system collects drainage from plant equipment drains, floor drains and sumps drainage in the drywell, reactor building, turbine building, radwaste building, and onsite storage facility. The system includes pumps, tanks, filters, oil coalescers, precoat filters, evaporators, and demineralizers, and the associated piping, valves, instruments and controls needed to collect, monitor, process and store liquid waste. The system returns radioactive liquid wastes to the plant for reuse, or the processed waste can be transferred to the circulating-water reservoir blowdown line for controlled discharge.

The solid radwaste system includes equipment to collect, process (solidify or dewater), and package liquid and wet solid wastes and slurries from the liquid radwaste system and other process systems. The system includes two subsystems for handling waste resulting from processing liquids: a vendor supplied system and an asphalt-extruder process system. The vendor supplied system, located in the radwaste onsite storage facility, normally processes liquid radwaste by dewatering or solidification, etc. The asphalt-extruder process system, also located in the radwaste building, has never been operational. The solid radwaste system also includes equipment used to package, store, and prepare compressible dry wastes for transport.

The radioactive waste systems include components that support the primary containment pressure boundary. The system also includes nonsafety-related components that prevent backflow from the radwaste building into the reactor building during the probable maximum meteorological event (PMME).

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

- Support primary containment pressure boundary.

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

- Prevent backflow from the radwaste building into the reactor building during the PMME.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

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

RHR Complex Drains and OSB Potable Water

The purpose of the RHR complex drains and OSB potable water system (system code X42) is to provide miscellaneous drainage and plumbing equipment. The system code includes floor drain piping and components in the RHR complex. The nonsafety-related RHR complex drain system is segregated into two types of wastes, oil-free water and oil-contaminated water. Equipment and floor drains that are potentially contaminated with oil drain to a manway that is connected by an overflow line to the liquid waste holding pond (also known as the chem waste pond). Equipment and floor drains that are oil free drain to another manway that is connected by an overflow line to the circulating water reservoir.

System code X42 also includes a small number of components that support distribution of potable water in the OSB. These nonsafety-related components support operation of the potable water system (system code P21) and support no regulated event.

The RHR complex drains and OSB potable water system has no intended functions for 10 CFR 54.4(a)(1).

The RHR complex drains and OSB potable water 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 RHR complex drains and OSB potable water system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function (floor drains prevent flooding from fire protection system) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

UFSAR References

Floor and Equipment Drains

Section 9.3.3

Radioactive Waste

Section 1.2.2.14.4
Section 1.2.2.14.5
Section 3.4.4.4.2
Section 9.3.3
Section 9A.5
Section 11.2
Section 11.5

RHR Complex Drains and OSB Potable Water

Section 9.2.4 (potable water)
Section 9.3.3.2

Components Subject to Aging Management Review

Components of the floor and equipment drains system supporting the secondary containment pressure boundary are reviewed in Section 2.3.2.6, Containment Penetrations. Radioactive waste system components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. Nonsafety-related components of these systems not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining plant drains components are reviewed as listed below.

Table 2.3.3-14 lists the component types that require aging management review.

Table 3.3.2-14 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-M-2032	LRA-M-2535
LRA-M-2032-1	LRA-M-2040
LRA-M-2223	LRA-M-N-2050
LRA-M-2224	LRA-M-N-2054

Table 2.3.3-14
Plant Drains System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Drain	Pressure boundary
Piping	Pressure boundary
Trap	Pressure boundary
Valve body	Pressure boundary

2.3.3.15 Fuel Oil

System Description

The review of fuel oil includes components containing fuel oil from system code R30, emergency diesel generators (Section 2.3.3.10); system code R11, auxiliary electrical peaker combustion turbine generator system (Section 2.3.3.9); and system code P80, fire protection (Section 2.3.3.7).

Emergency Diesel Generators Fuel Oil

The EDG system includes fuel oil for operation of the diesel generator and stores sufficient fuel for continuous operation of the EDG for seven days. The EDG fuel oil components are storage tanks, transfer pumps, fuel oil day tanks, fuel oil pumps, and the associated piping, valves, strainers, filters, and controls. Each EDG has its own individual fuel oil supply components. Each diesel generator set is supplied by a 42,000-gal diesel-fuel storage tank located adjacent to the associated diesel generator. Two redundant motor-driven fuel-oil transfer pumps deliver fuel from the storage tank to a 550-gal fuel-oil day tank. Fuel flows by gravity from the day tank to the suction of the engine-driven fuel pump. Each EDG is provided with a full capacity engine-driven fuel oil pump and a motor-driven fuel oil pump, which is available for use during maintenance or other times when the engine-driven pump may be unavailable.

Fuel oil for the EDG system supports the following intended functions for the EDGs:

- Provide power, in the event of a loss of offsite power, to the ESF electrical loads for safe reactor shutdown and to mitigate the consequences of a design basis accident. [10 CFR 54.4(a)(1)]
- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). [10 CFR 54.4(a)(3)]

Fuel oil for the EDG 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.

Auxiliary Electrical Peaker Combustion Turbine Generator Fuel Oil

The purpose of the auxiliary electrical peaker combustion turbine generator (CTG) system is to provide an independent source of electrical power. The CTG system (specifically CTG 11-1) is used as an alternate source of power for station blackout and safe shutdown following a fire as part of the alternate shutdown system. The CTG system includes four oil-fired turbine generators, fuel oil storage tanks, a starting diesel for CTG 11-1, and a standby diesel generator used to start CTG 11-2, 11-3, and 11-4.

The CTG starting diesel for CTG 11-1 is located in an enclosed heated compartment and is equipped with a float tank, which provides an initial supply of warm fuel oil to ensure operability. Diesel fuel is maintained in the CTG fuel oil tank with a fuel level maintained by plant procedures to ensure nominal fuel availability for 72 hours of operations for a single CTG unit at a 10-MW load.

Fuel oil for the CTG system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

Fuel oil for the CTG system supports the following intended functions of the CTG system.

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). [10 CFR 54.4(a)(3)]
- Perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63). [10 CFR 54.4(a)(3)]

Fire Protection Fuel Oil

The fire pump diesel is provided with fuel oil from a 275-gallon fuel oil tank for eight continuous hours of operation. The diesel fire pump has the capacity to supply the required fire protection water demands. The diesel fire pump is a 2500-gpm diesel-driven fire pump located in the general service water pump house.

Fuel oil for the fire protection system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

Fuel oil for the fire protection system supports the following intended function of the fire protection system.

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). [10 CFR 54.4(a)(3)]

UFSAR References

EDG Fuel Oil
Section 9.5.4

CTG Fuel Oil
Section 7.5.2.5.2

Fire Protection Fuel Oil
Section 9.5.1

Components Subject to Aging Management Review

Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining fuel oil components are reviewed as listed below.

Table 2.3.3-15 lists the component types that require aging management review.

Table 3.3.2-15 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-M-2135-1

LRA-M-N-2048

LRA-M-N-2049

**Table 2.3.3-15
Fuel Oil System
Components Subject to Aging Management Review**

Component Type	Intended Function
Bolting	Pressure boundary
Filter housing	Pressure boundary
Hose	Pressure boundary
Manifold	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.16 Primary Containment Monitoring and Leakage Detection

System Description

Primary containment monitoring and leakage detection functions are performed by various systems that are mainly reviewed elsewhere in this application. Primary containment monitoring and leakage detection features that are not included with other system reviews are evaluated in this section.

As described in UFSAR Section 6.2.1.5.1, primary containment monitoring is designed to make available to the plant operators sufficient information to permit normal operation, to assist the operator in assessing the consequences of an accident or an incident, and to determine the effectiveness of control actions taken to mitigate the effects of the postulated event.

Functions of primary containment monitoring include multipoint measurement and recording of hydrogen and oxygen concentrations, gaseous radiation levels, pressure, temperatures, and water levels in the drywell and pressure suppression chamber. Suppression chamber water temperatures and drywell vessel wall and atmospheric temperatures are also measured and recorded.

As described in UFSAR Section 5.2.7, RCPB leakage detection consists of temperature, pressure, flow, and fission product sensors with associated instrumentation and alarms. Abnormal leakage is detected in the following systems:

- Main steam lines
- RWCU system
- RHR system
- RCIC system
- Reactor feedwater system
- HPCI system
- Reactor recirculation system

Small leaks are generally detected by temperature and pressure changes, fill-up rate of drain sumps, and fission product concentration inside the primary containment. Large leaks are also detected by changes in reactor water level and changes in flow rates in process lines.

Leakage into systems that are directly or indirectly connected to the RCPB is detected by the leak detection system. The RHR system service water, general service water, and reactor building closed cooling water (RBCCW) have been provided with process radiation monitors for the detection of intersystem leaks.

Leakage into systems that are normally connected to the RCPB through closed isolation valves is detected by pressure and temperature indications. The core spray, RCIC, and HPCI systems are in this category. Leakage into the RWCU system is detected by differential flow and temperature devices. The standby liquid control system (SLCS) is monitored for intersystem leakage by the system pressure and tank level indicators provided.

Also included with this review of primary containment monitoring and leak detection are two related functions:

- Maintain piping and component integrity to support post-accident plate-out of fission products from MSIV leakage.

With the change in the LOCA analyses to use the alternate source term methodology (License Amendment 160), the MSIV leakage control system is no longer credited for post-LOCA activity leakage mitigation. However, plate-out of fission products is assumed to occur in the piping downstream of the second (outboard) MSIVs to the third MSIVs. Piping and components within the plate-out boundary are seismically qualified but not all are safety-related. Support of plate-out is not a safety function.

- Support operation of the RPS turbine first-stage pressure transmitters.

As described in UFSAR Section 7.2.1.1.3.1, four turbine first-stage pressure transmitters are provided to initiate the automatic bypass of the turbine control valve fast closure and turbine stop valve closure scrams when the first-stage pressure is below a preset fraction of rated pressure during shutdowns. The transmitters are arranged so that no single failure can prevent a turbine stop valve closure scram or turbine control valve fast closure scram. Mechanical components supporting this function are safety-related.

This review of primary containment monitoring and leakage detection and related functions not reviewed elsewhere includes components from the following system codes:

- T50, Primary Containment Monitoring
- C71, Reactor Protection
- G33, Reactor Water Cleanup
- N11, Main and Reheat Steam (MSIV Leakage Control)
- B21, Nuclear Boiler (MSIV Leakage Control)
- N30, Main Turbine Generator and Auxiliaries
- P33, Process Sampling

Primary Containment Monitoring (PCM)

The purpose of the primary containment monitoring (PCM) system (system code T50) (also called the primary containment atmosphere monitoring system) is to provide sufficient information to plant operators to permit normal operation, to assist in the assessment of consequences of an accident or incident, and to determine the effectiveness of control actions taken to mitigate the effects of the postulated event. The PCM system is an information-advisory system that continuously monitors the following primary containment parameters:

- Primary containment atmosphere radioactivity.
- Primary containment hydrogen and oxygen concentration.
- Drywell atmosphere and liner (wall) temperature.
- Suppression chamber atmosphere and suppression pool water temperature.
- Drywell and suppression chamber pressures.
- Suppression pool water level.

Temperature measurements are performed by electrical components. Mechanical components of the system include pumps that draw containment air samples for analysis and valves, piping elements and related support equipment for the measurement of radioactivity, hydrogen and oxygen concentration, pressure and level. Most system components are located outside containment. Consequently, some system components support the containment pressure boundary.

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

- Provide sufficient information to plant operators to support mitigation of a postulated accident.
- Support primary containment pressure boundary.

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

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

Reactor Protection

The purpose of the reactor protection system (RPS) (system code C71) is to monitor certain reactor and plant parameters, sense abnormalities, and initiate a rapid, automatic shutdown of the reactor to prevent fuel damage when trip points are exceeded. The system includes the motor-generator power supplies, sensors, relays, bypass circuitry, and switches that are used in conjunction with inputs from other systems to initiate a reactor trip.

Among the parameters monitored by the RPS are turbine stop valve position and turbine control valve fast closure signal inputs, both of which can initiate a system trip. Four turbine first-stage pressure transmitters are provided to initiate the automatic bypass of the turbine control valve fast closure and turbine stop valve closure scrams when the first-stage pressure is below a preset fraction of rated pressure.

The RPS is primarily an instrument and control system using electrical components. However, there are a small number of piping and valve components of the system that support the turbine first-stage pressure transmitters. These are the only mechanical components of the system.

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

- Support the sensing line pressure boundary of the turbine first-stage pressure transmitters.

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

Reactor Water Cleanup

The purpose of the reactor water cleanup (RWCU) system (system code G33) is to remove particulate and dissolved impurities from the reactor coolant and to remove excess coolant from the reactor system. The RWCU system continuously purifies the reactor water. The system continuously removes water from the suction line of each reactor recirculation pump and from the reactor bottom head for decontamination by a demineralizer system, and then returns the water to the reactor through the feedwater system. Water may also be sent to the main condenser or to the radwaste system. The system includes pumps, regenerative and nonregenerative heat exchangers, filter-demineralizers, and supporting equipment, piping, valves, instruments, and controls.

The RWCU system includes components that form part of the reactor coolant pressure boundary and components that support the primary containment pressure boundary. The system also includes safety-related flow elements, with their associated flow sensing pressure boundaries, that monitor flow on nonsafety-related inlet and outlet lines of the system. Excess differential flow into and out of the system indicative of leakage results in system isolation. With the exception of these pressure boundary functions, the system has no safety function.

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

- Maintain integrity of reactor coolant pressure boundary.
- Support primary containment pressure boundary.
- Monitor system flows to determine system leakage.

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

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

Main and Reheat Steam

The main and reheat steam system (system code N11) is described in Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2).

The main and reheat steam system includes components that support the MSIV leakage control system. With the change in the LOCA analyses to use the alternate source term methodology (License Amendment 160), the MSIV leakage control system is no longer credited for post-LOCA activity leakage mitigation. However, plate-out of fission products is assumed to occur in the piping downstream of the second (outboard) MSIVs to the third MSIVs. Piping and components within the plate-out boundary are seismically qualified but not all are safety-related. Support of plate-out is not a safety function.

Main and reheat steam system components support the following system intended function for 10 CFR 54.4(a)(2).

- Maintain piping and component integrity to support post-accident plate-out of fission products from MSIV leakage.

Nuclear Boiler

The nuclear boiler system (system code B21) is described in Section 2.3.1.3, Nuclear Boiler.

System code B21 includes the MSIV leakage control system. The MSIV leakage control system was designed to inject air after a LOCA into the main steam piping between the inboard and outboard MSIVs and between the outboard MSIV and the third main steam isolation valve in the steam line to ensure that leakage past the MSIVs was within analyzed values. With the change in the LOCA analyses to use the alternate source term methodology (License Amendment 160), the MSIV leakage control system is no longer credited for post-LOCA activity leakage mitigation. For each main steam line, the injection air line to the space between the inboard and outboard MSIVs has been plugged. Besides drain valves from these lines, there are no valves between the isolation plugs and the main steam lines.

Although the MSIV leakage control system is no longer credited for post-LOCA activity leakage mitigation, plate-out of fission products is assumed to occur in the piping downstream of the second (outboard) MSIVs to the third MSIVs in the turbine building. Piping and components within the plate-out boundary are seismically qualified, but not all are safety-related. Support of plate-out is not a safety function.

Nuclear boiler system components support the following system intended function for 10 CFR 54.4(a)(2).

- Maintain piping and component integrity to support post-accident plate-out of fission products from MSIV leakage.

Main Turbine Generator and Auxiliaries

The main turbine generator and auxiliaries (system code N30) are described in Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2).

Main turbine generator and auxiliaries system components support the following system intended function for 10 CFR 54.4(a)(2).

- Support operation of the RPS turbine first-stage pressure transmitters.

Process Sampling

The purpose of the process sampling system (system code P33) is to provide process information to monitor plant conditions and equipment performance. Representative liquid and gas samples are taken automatically and/or manually during normal plant operation for laboratory or on-line analyses.

Grab samples for laboratory analysis may be taken locally near the process point or remotely at a central sampling station. For local grab samples, a sample line is routed from the process pipe to the nearest accessible area for plant personnel. For remote grab samples, a sample line is routed from the process pipe to the central sampling station where they are cooled if necessary. Central sampling stations are located in the radwaste, turbine, and reactor buildings.

Continuous samples are routed to the central sampling station where the samples are regulated for proper flow and are temperature controlled as required by the instrument manufacturer. Continuous samples are provided with a means for taking grab samples at the central sampling station.

The process sampling system includes a small number of safety-related components that support the main and reheat steam system pressure boundary between the second and third MSIVs. With the change in the LOCA analyses to use the alternate source term methodology

(License Amendment 160), the MSIV leakage control system is no longer credited for post-LOCA activity leakage mitigation. However, plate-out of fission products is assumed to occur in the piping downstream of the second (outboard) MSIVs to the third MSIVs. Piping and components within the plate-out boundary are seismically qualified but not all are safety-related.

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

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

- Maintain piping and component integrity to support post-accident plate-out of fission products from 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 process sampling system has no intended functions for 10 CFR 54.4(a)(3).

UFSAR References

PCM	*RWCU*
Section 6.2.1.5	Section 3.6.2.2.5
Section 7.1.2.1.22	Section 5.5.8.2
Section 7.6.1.12	Section 7.6.1.8.8
RPS	*Process Sampling*
Section 3.1.2.2.1	Section 1.2.2.15.13
Section 7.2	Section 9.3.2
	Section 11.4.4

Components Subject to Aging Management Review

PCM system components supporting the safety-related pressure boundary of the control air system are reviewed in Section 2.3.3.6, Compressed Air. RWCU Class 1 components supporting the reactor coolant and primary containment pressure boundaries are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Nonsafety-related components of these systems not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) or Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2). Remaining components supporting the primary containment monitoring and leakage detection system are reviewed as listed below.

Table 2.3.3-16 lists the component types that require aging management review.

Table 3.3.2-16 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-M-2002	LRA-I-2156-02
LRA-M-2046	LRA-I-2400-10
LRA-M-2089	LRA-I-2679-01
LRA-M-3045	

Table 2.3.3-16
Primary Containment Monitoring and Leakage Detection System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Coil	Pressure boundary
Flex connection	Pressure boundary
Flow element	Pressure boundary
Housing	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Plate-out Pressure boundary
Pump casing	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.3.17 Miscellaneous 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 Fermi 2, certain components and piping outside the safety class pressure boundary must be structurally sound 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, Scoping and Screening Results: Structures.

Pipe Whip, Jet Impingement, or Harsh Environments

Systems containing nonsafety-related high energy lines that can affect safety-related equipment are included in the review for the criterion of 10 CFR 54.4(a)(2). 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.

System Code	System Name	Section Describing System
C11	Control Rod Drive	Section 2.3.3.1, Control Rod Drive
C41	Standby Liquid Control	Section 2.3.3.2, Standby Liquid Control
D11	Process Radiation Monitoring	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
G11	Radioactive Waste	Section 2.3.3.14, Plant Drains
G33	Reactor Water Cleanup	Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection
G41	Fuel Pool Cooling and Cleanup	Section 2.3.3.4, Fuel Pool Cooling and Cleanup
G51	Torus Water Management	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
H21	Local Panels and Racks	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
N62	Off-Gas Process and Vacuum	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P21	Potable Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P33	Process Sampling	Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection
P34	Post-Accident Sampling	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

System Code	System Name	Section Describing System
P41	General Service Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P42	Reactor Building Closed Cooling Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P43	Turbine Building Closed Cooling Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P44	Emergency Equipment Cooling Water	Section 2.3.3.5, Emergency Equipment Cooling Water
P45	Emergency Equipment Service Water	Section 2.3.3.3, Service Water
P46	Supplemental Cooling Chilled Water	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P50	Station Air, Control Air and Emergency Breathing Air Systems	Section 2.3.3.6, Compressed Air
P61	Auxiliary Boiler	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P70	Waste Oil	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P79	On-Line Noble Chemistry Injection	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
P80, T80, U80, V80, X80	Fire Protection	Section 2.3.3.7, Fire Protection – Water
P85	Zinc Injection	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
R30	Emergency Diesel Generators	Section 2.3.3.10, Emergency Diesel Generator
T21, T22	Reactor/Auxiliary Building	Section 2.3.3.6, Compressed Air
T25	Storage Pools	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
T41	Reactor/Auxiliary Building HVAC	Section 2.3.3.11, Heating, Ventilation and Air Conditioning

System Code	System Name	Section Describing System
T45	Floor and Equipment Drains	Section 2.3.3.14, Plant Drains
T48	Containment Atmospheric Control	Section 2.3.3.13, Containment Atmospheric Control
T49	Primary Containment Pneumatics	Section 2.3.3.6, Compressed Air
T50	Primary Containment Monitoring	Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection
U41	Turbine Building HVAC	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
U42	Turbine Building Potable Water and Plumbing	Section 2.3.3.17, Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)
X41	RHR Complex and Office Service Building (OSB) HVAC	Section 2.3.3.11, Heating, Ventilation and Air Conditioning
X42	RHR Complex Drains and OSB Potable Water	Section 2.3.3.14, Plant Drains

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.

The systems described below have 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 2.3.2.6, Containment Penetrations for primary containment penetrations).

Process Radiation Monitoring

The purpose of the process radiation monitoring (PRM) system (system code D11) is to determine the content of radioactive material in various gaseous and liquid process and effluent streams. The system includes radiation monitors and monitoring subsystems on process liquid and gas lines that may serve as discharge routes for radioactive materials. Protective actions are initiated by some monitoring subsystems to limit the release or transfer of radioactive materials. Other monitoring subsystems provide information for operational requirements.

The PRM system monitors the main steam lines, ventilation systems, gaseous process systems and liquid process systems. Monitoring subsystems for process systems such as the main steam lines consist of EIC components. Other monitoring subsystems such as those for the control center emergency air intakes include mechanical components (e.g., pumps, filters, sample probes, piping and valves).

In addition to its intended function for 10 CFR 54.4(a)(2), the PRM system has the following intended functions for 10 CFR 54.4(a)(1).

- Support monitoring of plant process streams to limit transfer of radioactive materials (CCHVAC).
- Maintain pressure boundary of monitored system (CCHVAC, RHRSW, SGTS).

Components of the PRM system supporting pressure boundaries of the monitored system are reviewed with the respective system: Section 2.3.2.7, Standby Gas Treatment; Section 2.3.3.3, Service Water; and Section 2.3.3.12, Control Center Heating, Ventilation and Air Conditioning.

UFSAR References: Section 11.4

Torus Water Management

The purpose of the torus water management system (TWMS) (system code G51) is to provide thermal mixing of the torus water, torus water volume inventory control, torus water quality maintenance, and to drain and fill the torus to facilitate inside torus recoating, inspections, and repair work. The TWMS includes two pumps, piping, valves, instruments and controls.

The TWMS pumps take suction from two torus connections placed on opposite sides of the torus. Water is similarly returned to the torus using two different torus connections also on opposite sides of the torus. The return lines are part of the core spray and residual heat removal system test lines. The suction and return line connections to the torus support the primary containment boundary. The system has no other safety function.

The TWMS pumps transfer torus water back to the torus for thermal mixing, or to the condensate system for cleanup or draining. Clean condensate from the condensate reject line to the condensate storage tank provides return water to the torus. Torus draining is accomplished by using the TWMS pumps to transfer torus water directly to the main turbine condenser for storage.

Torus filling is accomplished using a condensate system pump to transfer water back to the torus through the TWMS return piping.

In addition to its intended function for 10 CFR 54.4(a)(2), the TWMS has the following intended function for 10 CFR 54.4(a)(1).

- Support primary containment pressure boundary.

Components of the TWMS supporting the suppression pool (primary containment) pressure boundary are reviewed in Section 2.3.2.3, Core Spray; Section 2.3.2.2, Residual Heat Removal; Section 2.3.2.4, High Pressure Coolant Injection; and Section 2.3.2.6, Containment Penetrations.

UFSAR References: Section 9.2.8

Local Panels and Racks

The purpose of the local panels and racks system (system code H21) is to provide physical and functional support of instrument and control equipment for various plant systems. The panels and racks are structural components that support electrical and mechanical instrument and control equipment. Some generic mechanical components (e.g., valve manifolds, tubing, fittings) that support part of the process system (e.g., RHR, RCIC) pressure boundary, are assigned to the local panels and racks system code, H21.

In addition to its intended function for 10 CFR 54.4(a)(2), the local panels and racks system has the following intended function for 10 CFR 54.4(a)(1).

- Support the safety-related pressure boundary of connected systems.

The local panels and racks system has the following intended functions for 10 CFR 54.4(a)(3).

- Support the pressure boundary of connected systems with intended functions that demonstrate compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Support the pressure boundary of connected systems with intended functions that demonstrate compliance with the Commission's regulations for station blackout (10 CFR 50.63).

Components of the system supporting the intended functions of connected systems are included in the applicable aging management review for the connected systems: Section 2.3.1.2, Reactor Coolant Pressure Boundary; Section 2.3.2.2, Residual Heat Removal; Section 2.3.2.3, Core Spray; Section 2.3.2.4, High Pressure Coolant Injection; Section 2.3.2.5, Reactor Core Isolation

Cooling; Section 2.3.3.5, Emergency Equipment Cooling Water; Section 2.3.3.6, Compressed Air; and Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection.

UFSAR References: Table 3.10-3

Off-Gas Process and Vacuum

The purpose of the offgas and vacuum system (system code N62) is to remove gaseous radwaste from the main condenser to maintain condenser vacuum. The system also maintains the concentration of the hydrogen gas below the explosive limit and processes and controls the release of gaseous radioactive effluents to the site environs.

The offgas system consists of two effluent streams, one from the mechanical vacuum pump and the second from the steam-jet air ejectors. The mechanical vacuum pump is used before startup to reduce the condenser pressure to approximately 4 in. Hg abs. Air removed by the mechanical vacuum pumps is not processed by the offgas system but is routed through a section of piping that provides a two-minute delay. This is acceptable because the vacuum pumps are in service when little or no radioactive gases are present. Once condenser vacuum has been reduced and sufficient steam is available, the steam-jet air ejectors are started manually. The mechanical vacuum pumps and the steam-jet air ejectors themselves are components in the condenser and auxiliaries system (system code N61) (see Section 2.3.4.3).

The offgas system processes the condenser offgas by delaying the offgas so that significant decay of radionuclides is allowed before it is released from the plant. The offgas system includes four subsystems:

(1) The recombiner subsystem (water separators, preheaters, recombiners).

(2) The air drying subsystem (condensers, aftercoolers, precoolers).

(3) The charcoal adsorption subsystem (delay pipe, sand filters, chillers, charcoal adsorbers).

(4) The water ring exhaust pump subsystem (absolute filter, water ring pumps, water ring buffer tank).

During plant operation, offgas discharged from the steam-jet air ejector is diluted with steam to keep hydrogen concentrations below 4.0 percent. The gas is heated by steam in the preheater and enters the recombiner, where the hydrogen and oxygen are recombined catalytically into water. After recombination, the gases are cooled and dehumidified. The gas then enters a 2.2-minute (nominal) delay pipe, followed by a sand filter. The gas is further cooled and enters the ambient temperature charcoal adsorbers. The discharge from the adsorber system is filtered mainly to remove any charcoal fines that may have been carried out of the last charcoal bed.

The gas is then pumped into the offgas discharge piping. The effluent from the offgas system is discharged from the plant after dilution in the reactor building ventilation system exhaust.

UFSAR References: Section 11.3.2.7

Potable Water

The purpose of the potable water system (system code P21) is to provide potable water to the station for various purposes. Potable water supplies the condensate makeup system, sanitary plumbing, drinking fountains, washrooms, kitchen facilities, safety showers, and turbine building HVAC evaporative coolers.

The potable water system consists of an underground distribution header with branches to the various facilities that require service. The system is supplied by the Frenchtown Water System, with water being stored in the 100,000-gallon elevated storage tank on site.

UFSAR References: Section 9.2.4

Post-Accident Sampling

The purpose of the post-accident sampling system (PASS) (system code P34) is to provide the capability of obtaining reactor coolant and containment atmosphere samples under accident conditions. The PASS can obtain samples of reactor coolant, drywell atmosphere, suppression pool atmosphere and pool liquid, and reactor building (secondary containment) atmosphere. The system supports gamma isotopic analysis and the determination of selected radionuclide concentrations. The PASS also permits additional analyses of liquids for total gas, dissolved hydrogen, pH, conductivity, dissolved oxygen, boron and chlorides, and analysis of containment atmospheres for hydrogen and oxygen.

The system consists of a liquid and gas sample station and control panel located outside the reactor building, and a piping station, sample lines and isolation valves located inside the reactor building. Some safety-related components of the system are part of the reactor coolant pressure boundary and others support the primary containment pressure boundary. The mechanical components of the system have no other safety function.

In addition to its intended function for 10 CFR 54.4(a)(2), the PASS has the following intended functions for 10 CFR 54.4(a)(1).

- Support reactor coolant pressure boundary.
- Support primary containment pressure boundary.

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

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

Safety-related components supporting reactor coolant sampling are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary and Section 2.3.2.2, Residual Heat Removal. Other safety-related components supporting primary containment pressure boundary are reviewed in Section 2.3.2.6, Containment Penetrations.

UFSAR References: Section 11.4.4

General Service Water

The purpose of the nonsafety-related general service water (GSW) system (system code P41) is to provide cooling water to various plant heat loads, principally in the reactor, turbine, and radwaste buildings, during normal station operation. The GSW system cools various nonsafety-related plant auxiliary systems such as the reactor building closed cooling water and turbine building closed cooling water systems during all normal plant operating modes. The GSW system also provides the source of makeup water for the plant fire protection system and circulating water reservoir and serves as a source of makeup water for the RHR complex.

The GSW system takes its water from Lake Erie. The lake water is drawn into an intake canal, passed through a trash rack and a traveling screen, and enters the GSW pump pit. The five GSW pumps take suction from the intake pit and discharge the water into a common header. The once-through GSW discharges into the station's circulating water system, where its heat load is rejected in the two natural-draft cooling towers. The GSW thus serves as cooling tower makeup.

UFSAR References: Sections 1.2.2.15.8.2 and 9.2.1

Reactor Building Closed Cooling Water

The purpose of the reactor building closed cooling water (RBCCW) system (system code P42) is to remove heat from the auxiliary equipment housed in the reactor building and auxiliary building during normal plant operation. The RBCCW system includes three half-capacity water pumps, two half-capacity heat exchangers cooled by the GSW system, a makeup tank supplied by the demineralized makeup water system, supply and return distribution piping, and valves, instruments and controls. During normal operation, two heat exchangers and two pumps are in service, and one pump is retained in standby. Normally, the nonsafety-related RBCCW system supplies cooling water to both safety-related and nonsafety-related components supplied by the EECW piping system. Under normal operating conditions, the EECW pumps and heat exchangers are in standby mode. When required, RBCCW is isolated, and cooling water is supplied to essential loads by the EECW pumps and heat exchangers.

The RBCCW system also includes two RBCCW supplemental cooling loops, each with two pumps, a heat exchanger cooled by the supplemental cooling chilled water system, piping, valves, instruments, and controls to provide additional cooling capacity during periods of high GSW system temperature. Each RBCCW supplemental cooling loop takes suction from the RBCCW return header downstream of the RBCCW/EECW system interface, passes this water through a heat exchanger, and discharges the cooled water to the RBCCW supply header just upstream of the RBCCW/EECW interface. When the RBCCW supplemental cooling pumps are in operation, each RBCCW supplemental cooling loop alone provides RBCCW flow to its respective division of EECW; thus the RBCCW supplemental cooling loops operate in parallel with the two RBCCW pumps that service the nonessential loads outside of the EECW loops.

The RBCCW system includes a small number of safety-related components that form part of the EECW system pressure boundary. The RBCCW system has no other safety function.

In addition to its intended function for 10 CFR 54.4(a)(2), the RBCCW system has the following intended function for 10 CFR 54.4(a)(1).

- Support the EECW system pressure boundary.

RBCCW system components supporting the EECW system pressure boundary are reviewed in Section 2.3.3.5, Emergency Equipment Cooling Water.

UFSAR References: Sections 7.6.1.14.1.1 and 9.2.2

<u>*Turbine Building Closed Cooling Water*</u>

The purpose of the turbine building closed cooling water (TBCCW) system (system code P43) is to remove heat from nonsafety-related auxiliary equipment housed in the turbine building. The TBCCW system includes three half-capacity water pumps, two full-capacity heat exchangers cooled by the GSW system, a makeup tank, supply and return distribution piping, and valves, instruments and controls.

During normal operation, one heat exchanger and two pumps operate to remove all the equipment heat loads. Makeup to the system as well as system expansion and contraction due to load changes are provided by a makeup tank. Makeup water is automatically supplied via a tank level control valve from the demineralized makeup water system.

UFSAR References: Sections 7.6.1.14.1.2 and 9.2.7

Supplemental Cooling Chilled Water

The purpose of the supplemental cooling chilled water (SCCW) system (system code P46) is to provide chilled water that will be used to lower the temperature of the cooling water supply to EECW that is normally cooled by RBCCW. The SCCW system is designed to remove the heat produced by the EECW system during normal operation. The SCCW system transfers the heat it has removed to the GSW system via mechanical chillers. The SCCW system is not required for the safe shutdown of the reactor or for accident mitigation.

The RBCCW system is cooled by the GSW system. The RBCCW supplemental cooling loops are intended for operation when the GSW supply temperature is greater than 60°F. The SCCW system provides a source of chilled water for cooling the water supplied to each division of EECW serviced by the RBCCW supplemental cooling loops. The GSW system provides service water for condenser cooling of the SCCW chillers.

The SCCW system consists of three half-capacity chillers, three half-capacity chilled water pumps, a chilled water expansion tank, and associated valves and controls.

UFSAR References: Section 9.2.9

Auxiliary Boiler

The purpose of the auxiliary boiler system (system code P61) is to provide low pressure steam for plant heating. The nonsafety-related system includes two auxiliary steam boilers, a deaerating heater, and the associated fuel oil, combustion air and feedwater/condensate equipment. The boilers and their associated auxiliary equipment are located in the auxiliary boiler house.

UFSAR References: Sections 1.2.2.15.16 and 9.4.8

Waste Oil

The purpose of the waste oil system (system code P70) is to support the operation of the main turbine and reactor feedwater pump lube oil systems. The waste oil system provides equipment to collect, transfer, purify, store and dispose of used lube oil. The nonsafety-related system includes pumps, piping, valves, instruments and controls, an oil/water separator unit and waste oil storage tank.

UFSAR References: None

On-Line Noble Chemistry Injection

The purpose of the on-line noble chemistry (OLNC) injection system (system code P79) is to inject a dilute solution of platinum or other noble metals into the reactor feedwater system to slow or mitigate intergranular stress corrosion cracking (IGSCC) in the reactor vessel and attached reactor coolant system piping. The nonsafety-related OLNC injection system consists of piping, valves, controls, instrumentation, and associated equipment that injects a dilute solution of noble metal into the reactor feedwater system via the reactor water cleanup system.

UFSAR References: Section 10.4.11

Zinc Injection

The purpose of the zinc injection system (system code P85) is to continuously inject a dilute solution of zinc oxide into the reactor feedwater system to control radiation buildup on out-of-core primary coolant piping. The nonsafety-related system includes piping, valves, controls, instrumentation, and associated equipment that dissolves zinc oxide pellets to create a dilute solution of zinc oxide that is delivered to the suction of the reactor feedwater pumps.

UFSAR References: Sections 5.2.3.4 and 10.4.9

Storage Pools

The purpose of the storage pools system (system code T25) is to provide miscellaneous support equipment for the fuel storage pools. The mechanical components of the system support the washdown of spent fuel casks. These nonsafety-related components support no safety function.

UFSAR References: None

Turbine Building HVAC

The purpose of the turbine building ventilation system (system code U41) is to provide a suitable environment for personnel and to ensure the integrity of equipment and controls located in the turbine building. The turbine building is heated, cooled, and ventilated during normal and shutdown operation by a circulating air system. The building is heated by the ventilation air intake heating coils, and unit space heaters which are serviced by the auxiliary boiler. Cooling of the building is accomplished by circulating outside air throughout the ventilation system. Outside air enters the building through an intake on top of the building and passes through an evaporative air cooler cooling unit, dampers, a filter bank, heating coils, a shutoff damper, and two of the three half capacity intake fans. The air is distributed and circulated by ducts, dampers and additional booster fans and discharged through the exhaust enclosure by two of the three half-capacity fans. Compressor/condenser air conditioning units provide additional cooling to selected areas and equipment. The system is not safety-related.

UFSAR References: Section 9.4.4

Turbine Building Potable Water and Plumbing

The turbine building potable water and plumbing system (system code U42) includes a small number of nonsafety-related components supporting various sumps and drains in the turbine building.

UFSAR References: None

UFSAR References

The following table lists the UFSAR references for systems described in this section.

System Code	System	UFSAR Reference
D11	Process Radiation Monitoring	Section 11.4
G51	Torus Water Management	Section 9.2.8
H21	Local Panels and Racks	Table 3.10-3
N62	Off-Gas Process and Vacuum	Section 11.3.2.7
P21	Potable Water	Section 9.2.4
P34	Post-Accident Sampling	Section 11.4.4
P41	General Service Water	Sections 1.2.2.15.8.2 and 9.2.1
P42	Reactor Building Closed Cooling Water	Sections 7.6.1.14.1.1 and 9.2.2
P43	Turbine Building Closed Cooling Water	Sections 7.6.1.14.1.2 and 9.2.7
P46	Supplemental Cooling Chilled Water	Section 9.2.9
P61	Auxiliary Boiler	Sections 1.2.2.15.16 and 9.4.8
P70	Waste Oil	None
P79	On-Line Noble Chemistry Injection	Section 10.4.11
P85	Zinc Injection	Sections 5.2.3.4 and 10.4.9

System Code	System	UFSAR Reference
T25	Storage Pools	None
U41	Turbine Building HVAC	Section 9.4.4
U42	Turbine Building Potable Water and Plumbing	None

Components Subject to Aging Management Review

For each safety-to-nonsafety interface, nonsafety-related components connected to safety-related components were included up to one of the following:

(1) The first seismic anchor, which is defined as a device or structure that ensures that forces and moments are restrained in three orthogonal directions.

(2) An equivalent anchor (restraints or supports), which is defined as a boundary point that encompasses at least two supports in each of three orthogonal directions.

(3) A boundary determined using the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a flexible connection or the end of a piping run (such as a vent or drain line) or up to and including a base-mounted component.

(4) If the boundary could not be determined in accordance with (1), (2), or (3) above, then the boundary beyond the interface was determined from review of site-specific supporting analyses.

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 10 CFR 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 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 to provide reasonable assurance that those analysis assumptions remain valid through the period of extended operation.

Series 2.3.3-17-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 3.3.2-17-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.

System Code	System Name	Component Types	AMR Results
C11	Control Rod Drive	Table 2.3.3-17-1	Table 3.3.2-17-1
C41	Standby Liquid Control	Table 2.3.3-17-2	Table 3.3.2-17-2
D11	Process Radiation Monitoring	Table 2.3.3-17-3	Table 3.3.2-17-3
G11	Radioactive Waste	Table 2.3.3-17-4	Table 3.3.2-17-4
G33	Reactor Water Cleanup	Table 2.3.3-17-5	Table 3.3.2-17-5
G41	Fuel Pool Cooling and Cleanup	Table 2.3.3-17-6	Table 3.3.2-17-6
G51	Torus Water Management	Table 2.3.3-17-7	Table 3.3.2-17-7
H21	Local Panels and Racks	Table 2.3.3-17-8	Table 3.3.2-17-8
N62	Off-Gas Process and Vacuum	Table 2.3.3-17-9	Table 3.3.2-17-9
P21	Potable Water	Table 2.3.3-17-10	Table 3.3.2-17-10
P33	Process Sampling	Table 2.3.3-17-11	Table 3.3.2-17-11
P34	Post-Accident Sampling	Table 2.3.3-17-12	Table 3.3.2-17-12
P41	General Service Water	Table 2.3.3-17-13	Table 3.3.2-17-13
P42	Reactor Building Closed Cooling Water	Table 2.3.3-17-14	Table 3.3.2-17-14
P43	Turbine Building Closed Cooling Water	Table 2.3.3-17-15	Table 3.3.2-17-15
P44	Emergency Equipment Cooling Water	Table 2.3.3-17-16	Table 3.3.2-17-16
P45	Emergency Equipment Service Water	Table 2.3.3-17-17	Table 3.3.2-17-17
P46	Supplemental Cooling Chilled Water	Table 2.3.3-17-18	Table 3.3.2-17-18
P50	Station Air, Control Air and Emergency Breathing Air Systems	Table 2.3.3-17-19	Table 3.3.2-17-19

System Code	System Name	Component Types	AMR Results
P61	Auxiliary Boiler	Table 2.3.3-17-20	Table 3.3.2-17-20
P70	Waste Oil	Table 2.3.3-17-21	Table 3.3.2-17-21
P79	On-Line Noble Chemistry Injection	Table 2.3.3-17-22	Table 3.3.2-17-22
P80, T80, U80, V80, X80	Fire Protection	Table 2.3.3-17-23	Table 3.3.2-17-23
P85	Zinc Injection	Table 2.3.3-17-24	Table 3.3.2-17-24
R30	Emergency Diesel Generators	Table 2.3.3-17-25	Table 3.3.2-17-25
T21, T22	Reactor/Auxiliary Building	Table 2.3.3-17-26	Table 3.3.2-17-26
T25	Storage Pools	Table 2.3.3-17-27	Table 3.3.2-17-27
T41	Reactor/Auxiliary Building HVAC	Table 2.3.3-17-28	Table 3.3.2-17-28
T45	Floor and Equipment Drains	Table 2.3.3-17-29	Table 3.3.2-17-29
T48	Containment Atmospheric Control	Table 2.3.3-17-30	Table 3.3.2-17-30
T49	Primary Containment Pneumatics	Table 2.3.3-17-31	Table 3.3.2-17-31
T50	Primary Containment Monitoring	Table 2.3.3-17-32	Table 3.3.2-17-32
U41	Turbine Building HVAC	Table 2.3.3-17-33	Table 3.3.2-17-33
U42	Turbine Building Potable Water and Plumbing	Table 2.3.3-17-34	Table 3.3.2-17-34
X41	RHR Complex and Office Service Building HVAC	Table 2.3.3-17-35	Table 3.3.2-17-35
X42	RHR Complex Drains and OSB Potable Water	Table 2.3.3-17-36	Table 3.3.2-17-36

License Renewal Drawings

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

System Code	System Name	LRA Drawings	
C11	Control Rod Drive	LRA-M-2081 LRA-M-5449	
C41	Standby Liquid Control	LRA-M-2082	
D11	Process Radiation Monitoring	LRA-I-2181-06	
G11	Radioactive Waste	LRA-M-2011 LRA-M-2011-1 LRA-M-2031 LRA-M-2032 LRA-M-2032-1 LRA-M-2042	LRA-M-2088 LRA-M-2534 LRA-M-2535 LRA-M-5357 LRA-M-5444
G33	Reactor Water Cleanup	LRA-M-2046 LRA-M-2047	
G41	Fuel Pool Cooling and Cleanup	LRA-M-2048	
G51	Torus Water Management	LRA-M-4100	
N62	Off-Gas Process and Vacuum	LRA-M-2002 LRA-M-2017-1	LRA-M-2017-1A LRA-M-2017-2
P21	Potable Water	LRA-M-2740	
P33	Process Sampling	LRA-M-5358 LRA-M-N-2052 LRA-M-N-2053	
P34	Post-Accident Sampling	LRA-I-2400-10 LRA-I-2400-25 LRA-I-2400-26	
P41	General Service Water	LRA-M-2010 LRA-M-2010-1	

System Code	System Name	LRA Drawings	
P42	Reactor Building Closed Cooling Water	LRA-M-5358 LRA-M-5358-1	
P43	Turbine Building Closed Cooling Water	LRA-M-2008 LRA-M-2008-1 LRA-M-2017-1	LRA-M-2017-1A LRA-M-2017-2
P44	Emergency Equipment Cooling Water	LRA-M-5357 LRA-M-5444	
P45	Emergency Equipment Service Water	LRA-M-5357 LRA-M-5444 LRA-M-N-2052	LRA-M-N-2053 LRA-M-N-2054
P46	Supplemental Cooling Chilled Water	LRA-M-2020	
P50	Station Air, Control Air and Emergency Breathing Air Systems	LRA-M-2008-1 LRA-M-2015	LRA-M-2085 LRA-M-4615
P61	Auxiliary Boiler	LRA-M-2271	
P70	Waste Oil	LRA-M-2042	
P79	On-Line Noble Chemistry Injection	LRA-M-2038	
P85	Zinc Injection	LRA-M-2012	
R30	Emergency Diesel Generators	LRA-M-N-2046 LRA-M-N-2047 LRA-M-N-2048	LRA-M-N-2049 LRA-M-N-2052 LRA-M-N-2053
T21, T22	Reactor/Auxiliary Building	LRA-SD-2541-02B	
T25	Storage Pools	None	
T41	Reactor/Auxiliary Building HVAC	LRA-M-2088 LRA-M-2271 LRA-M-2678 LRA-M-2707 LRA-M-2707-1 LRA-M-2740 LRA-M-2751	LRA-M-3445 LRA-M-4325 LRA-M-5357 LRA-M-5358 LRA-M-5444

System Code	System Name	LRA Drawings	
T45	Floor and Equipment Drains	LRA-I-2649-1 LRA-M-2223 LRA-M-2224	
T48	Containment Atmospheric Control	LRA-M-2087 LRA-M-3445 LRA-M-3445-1	
T49	Primary Containment Pneumatics	LRA-M-5007	
T50	Primary Containment Monitoring	LRA-I-2679-01	
U41	Turbine Building HVAC	LRA-I-2745-04 LRA-M-2008 LRA-M-2240	LRA-M-2271 LRA-M-2678 LRA-M-V-2002-1
U42	Turbine Building Potable Water and Plumbing	LRA-M-2042	
X41	RHR Complex and Office Service Building HVAC	LRA-M-N-2050	
X42	RHR Complex Drains and OSB Potable Water	LRA-M-N-2050	

Table 2.3.3-17-1
Control Rod Drive System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Cooler housing	Pressure boundary
Filter housing	Pressure boundary
Flow element	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-2
Standby Liquid Control System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

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

a. 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 2.3.3-17-3
Process Radiation Monitoring System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Piping	Pressure boundary
Sight glass	Pressure boundary
Tank	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-4
Radioactive Waste System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Separator	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-5
Reactor Water Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-6
Fuel Pool Cooling and Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Filter housing	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-7
Torus Water Management System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Flow element	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Screen	Pressure boundary
Strainer housing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-8
Local Panels and Racks System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

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

a. 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 2.3.3-17-9
Off-Gas Process and Vacuum System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Chiller housing	Pressure boundary
Coil	Pressure boundary
Condenser shell	Pressure boundary
Cooler housing	Pressure boundary
Flow element	Pressure boundary
Filter housing	Pressure boundary
Heater housing	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Recombiner	Pressure boundary
Rupture disc	Pressure boundary
Separator	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-10
Potable Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Piping	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-11
Process Sampling System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Chiller housing	Pressure boundary
Cooler housing	Pressure boundary
Filter housing	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-12
Post-Accident Sampling System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Chamber	Pressure boundary
Coil	Pressure boundary
Cooler housing	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Tank	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-13
General Service Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-14
Reactor Building Closed Cooling Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (plates)	Pressure boundary
Orifice	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-15
Turbine Building Closed Cooling Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Flow element	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-16
Emergency Equipment Cooling Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-17
Emergency Equipment Service Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Sight glass	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-18
Supplemental Cooling Chilled Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Chiller housing	Pressure boundary
Cooler housing	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-19
Station Air, Control Air and Emergency Breathing Air Systems
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Piping	Pressure boundary
Separator	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-20
Auxiliary Boiler System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

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

a. 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 2.3.3-17-21
Waste Oil System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Flex connection	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Trap	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-22
On-Line Noble Chemistry Injection System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Flex connection	Pressure boundary
Flow element	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-23
Fire Protection System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

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

a. 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 2.3.3-17-24
Zinc Injection System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-25
Emergency Diesel Generator System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Separator	Pressure boundary
Sight glass	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-26
Reactor/Auxiliary Building Systems
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

Component Type	Intended Function[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-27
Storage Pools System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Pump casing	Pressure boundary

a. 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 2.3.3-17-28
Reactor/Auxiliary Building HVAC System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Coil	Pressure boundary
Condenser shell	Pressure boundary
Cooler housing	Pressure boundary
Damper housing	Pressure boundary
Duct	Pressure boundary
Expansion joint	Pressure boundary
Filter housing	Pressure boundary
Heater housing	Pressure boundary
Humidifier	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-29
Floor and Equipment Drains System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Piping	Pressure boundary

a. 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 2.3.3-17-30
Containment Atmospheric Control System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-31
Primary Containment Pneumatics System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Piping	Pressure boundary
Tubing	Pressure boundary

a. 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 2.3.3-17-32
Primary Containment Monitoring System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Piping	Pressure boundary
Separator	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-33
Turbine Building HVAC System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Coil	Pressure boundary
Flow element	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-34
Turbine Building Potable Water and Plumbing System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.3-17-35
RHR Complex and Office Service Building HVAC System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

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

a. 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 2.3.3-17-36
RHR Complex Drains and Office Service Building Potable Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Piping	Pressure boundary

a. 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, Condensate Storage and Transfer
- Section 2.3.4.2, Feedwater and Standby Feedwater
- Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

2.3.4.1 Condensate Storage and Transfer

System Description

The purpose of the condensate storage and transfer system (system code P11) is to store and distribute condensate and demineralized water for use throughout the plant during normal and shutdown plant conditions. The system provides condensate to the HPCI, RCIC, CRD, standby feedwater, and core spray systems, and to the main condenser hotwell.

The condensate storage and transfer system includes two 600,000-gallon storage tanks—the condensate storage tank (CST) and the condensate return tank—and three pumps with associated receiving and distribution lines. The CST standpipe is designed so that the last 150,000 gallons is reserved for use by the HPCI or RCIC systems. The CST receives demineralized water from the demineralized water makeup system and may also receive low-conductivity water from the condensate return tank. There is also a normally closed balance line connecting these two tanks to allow gravity transfer from one tank to the other above the 150,000-gallon limiting level of the storage tank. Treated recycled condensate water is normally routed to the condensate return tank.

The condensate storage and transfer system also includes a 50,000-gallon demineralized makeup water storage tank and three pumps with associated receiving and distribution lines. The demineralized makeup water storage tank feeds transfer pumps which supply water to the condensate storage tank, auxiliary boiler, and the demineralized water distribution system.

The condensate storage and transfer system includes safety-related components that support the flow path to the HPCI and RCIC systems and components that support the containment pressure boundary. The system has no other safety function.

The condensate storage and transfer system has the following intended functions for 10 CFR 54.4(a)(1).

- Support the flow path from the CST to the HPCI and RCIC systems.
- Support the primary containment pressure boundary.

The condensate storage and transfer 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 condensate storage and transfer 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).

UFSAR References

Section 8.4

Section 9.2.6

Components Subject to Aging Management Review

Condensate storage and transfer system components supporting the feedwater and standby feedwater system pressure boundary are reviewed in Section 2.3.4.2, Feedwater and Standby Feedwater. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2). Remaining components 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-M-2006

LRA-M-2678

LRA-M-2004

Table 2.3.4-1
Condensate Storage and Transfer System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Flex connection	Pressure boundary
Flow element	Flow control Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.4.2 Feedwater and Standby Feedwater

System Description

The review of the feedwater and standby feedwater system includes the feedwater control system (system code C32).

Feedwater and Standby Feedwater

The purpose of the feedwater and standby feedwater system (system code N21) is to provide feed flow to the reactor pressure vessel. System code N21 includes the feedwater system, which supplies heated feedwater to the reactor during normal plant power operation, and the standby feedwater system, which functions as a separate means of providing flow to the reactor from the condensate storage tank.

The feedwater system consists of the reactor feed pumps, the sixth-stage high-pressure feedwater heaters, piping, valves, controls, and instrumentation. The turbine-driven reactor feed pumps take suction from the fifth-stage low-pressure feedwater heaters and discharge through the sixth-stage high-pressure feedwater heaters to provide the pressure head required at the NSSS. Feedwater is supplied to the reactor vessel through two lines that penetrate the drywell containment boundary. Feedwater system components form part of the reactor coolant pressure boundary. Apart from support of the reactor coolant and containment pressure boundaries, the feedwater system has no safety function.

The standby feedwater system provides condensate from the condensate storage tank to the feedwater system downstream of the sixth-stage feedwater heater. The standby feedwater system consists of two motor-driven pumps, piping, valves, controls and instrumentation. The standby feedwater system can support plant shutdown from the dedicated shutdown panel.

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

- Support the reactor coolant pressure boundary.
- Support the primary containment pressure boundary.

The feedwater and standby feedwater 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 feedwater and standby feedwater 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).

Feedwater Control

The purpose of the feedwater control system (system code C32) is to regulate the feedwater system flow rate so that proper RPV water level is maintained. The feedwater control system uses RPV water level, main steam flow, and feedwater flow signals to regulate feedwater flow. The system is arranged to permit single-element (level only), three-element (level, steam flow, feed flow), or manual operation.

The feedwater control system meets the power generation design bases by regulating the feedwater flow to (1) maintain adequate water level in the RPV according to the requirements of the steam separators and (2) prevent uncovering of the reactor core over the entire power range of the reactor. The system has no safety-related mechanical components.

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

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

- Perform a function (support pressure boundary of standby feedwater flow path) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

UFSAR References

Feedwater and Standby Feedwater	*Feedwater Control*
Section 9A.3.1.2	Section 7.1.1.2
Section 10.4.7	Section 7.1.2.1.9
Section 10.4.8	Section 7.7.1.3
	Figure 7.1-1

Components Subject to Aging Management Review

Components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Nonsafety-related components of these systems not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2). Remaining components are reviewed as listed below.

Table 2.3.4-2 lists the component types that require aging management review.

Table 3.4.2-2 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-M-2006	LRA-M-2081
LRA-M-2023	LRA-M-5083
LRA-M-2035	LRA-M-5715-4

**Table 2.3.4-2
Feedwater and Standby Feedwater System
Components Subject to Aging Management Review**

Component Type	Intended Function
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Flow element	Pressure boundary
Heat exchanger (end channel)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tube sheet)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

2.3.4.3 Miscellaneous 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 Fermi 2, certain components and piping outside the safety class pressure boundary must be structurally sound 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, Scoping and Screening Results: Structures.

Pipe Whip, Jet Impingement, or Harsh Environments

Systems containing nonsafety-related high energy lines that can affect safety-related equipment are included in the review for the criterion of 10 CFR 54.4(a)(2). 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.

System Number	System Name	Section Describing System
N11	Main and Reheat Steam	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N20	Condensate	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N21	Feedwater and Standby Feedwater	Section 2.3.4.2, Feedwater and Standby Feedwater
N22	Heater Drains	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N30	Main Turbine Generator and Auxiliaries	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N61	Condenser and Auxiliaries	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
N71	Circulating Water	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)
P11	Condensate Storage and Transfer	Section 2.3.4.1, Condensate Storage and Transfer
P95	Drips, Drains and Vents	Section 2.3.4.3, Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(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.

The systems described below have 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.

Main and Reheat Steam

The purpose of the main and reheat steam system (system code N11) is to transfer steam from the nuclear boiler system to the steam and power conversion systems. The main steam piping consists of four lines from the second (outboard) main steam isolation valves (MSIVs) to the 52-inch manifold installed ahead of the turbine stop valves, and piping from the manifold to the turbine stop valves, the two bypass steam lines, the steam line to the reactor feedwater pump turbines, and lines to plant auxiliaries. Major system components include the motor-operated (third) MSIVs and the turbine bypass valves (operated by the electrohydraulic control [EHC] subsystem of system code N30).

With the change in the LOCA analyses to use the alternate source term methodology (License Amendment 160), the MSIV leakage control system is no longer credited for post-LOCA activity leakage mitigation. However, plate-out of fission products is assumed to occur in the piping downstream of the second MSIVs to the third MSIVs. Piping and components within the plate-out boundary are seismically qualified, but not all are safety-related.

In addition to its intended function for 10 CFR 54.4(a)(2), the main and reheat steam system has the following intended function for 10 CFR 54.4(a)(2).

- Maintain piping and component integrity to support post-accident plate-out of fission products from MSIV leakage.

Safety-related components of the system are reviewed in Section 2.3.3.16, Primary Containment Monitoring and Leakage Detection.

UFSAR References: Sections 6.2.6, 10.3 and 10.4.4

Condensate

The purpose of the condensate system (system code N20) is to supply high purity water to the feedwater system, which in turn supplies the reactor pressure vessel. The condensate system includes the flow path from the main condenser through the condensate polishing demineralizers and feedwater heaters to the suction of the reactor feedwater pumps. The condensate system includes piping, valves, pumps, demineralizers and demineralizer support systems, heat exchangers, instruments and controls.

The condenser pumps take the deaerated condensate from the main condenser hotwell and deliver it through the steam-jet air ejector condensers, the gland steam condenser, and offgas condenser to the condensate polishing demineralizers. The condensate polishing demineralizer system processes all of the condensate from the condenser hotwell. Demineralizer effluent then passes to the heater feed pumps, which discharge through the drains coolers and the first, second, third, fourth, and fifth-stage low-pressure feedwater heaters to the reactor feedwater pumps.

The system also includes piping, valves, instruments, and controls that maintain the proper condenser hotwell inventory by means of makeup from and letdown to the condensate storage and transfer system (system code P11). Some of these condensate system components support the pressure boundary (by means of isolation) of the condensate storage and transfer system for safe shutdown following a fire.

In addition to its intended function for 10 CFR 54.4(a)(2), the condensate system has the following intended function for 10 CFR 54.4(a)(3).

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

Components of the system supporting isolation of the condensate storage and transfer system for safe shutdown following a fire, are reviewed in Section 2.3.4.1, Condensate Storage and Transfer.

UFSAR References: Sections 10.4.6 and 10.4.7

Heater Drains

The purpose of the heater drains system (system code N22) is to increase steam plant efficiency by preheating the incoming feedwater and thereby reducing the reactor plant heat load. Heater drains provide a path for cascading feedwater heater drain flow from reheat seal tanks, separator seal tanks, and the last two feedwater heaters (Nos. 5 and 6) and pump it to the suction of the reactor feed pumps. The system provides a path for cascading feedwater heater drain flow from the No. 4 feedwater heaters through the drain coolers and into the main condenser and maintains level control of feedwater heaters, reheater seal tanks, and separators. The heater drains system also includes vent lines that remove noncondensable gases from extraction steam condensed in the feedwater heaters and reheaters/separators and route these gases to the main condenser.

UFSAR References: Section 10.4.7.2

Main Turbine Generator and Auxiliaries

The purpose of the main turbine generator and auxiliaries (system code N30) is to convert steam to rotational energy for the generator, which converts it to electrical energy, and to provide extraction steam and moisture for feedwater heating. The system consists of the high-pressure and low-pressure turbines, moisture separators/reheaters (MSRs), main generator, exciter, controls, and supporting subsystems. Low-pressure extraction steam from the MSRs is supplied to the reactor feed pump turbines. The system extends from the turbine stop valves to the condenser.

Main steam enters the high-pressure turbine from the 52-inch main steam manifold through four 24-inch stop valves and governing control valves. After passing through the high-pressure turbine, steam is exhausted to the MSRs, where it is reheated by steam taken from the main steam lines ahead of the turbine stop valves. From the MSRs, steam flows through six intermediate stop valves and six intercept valves into steam lines leading to three low-pressure turbines. Steam from each low-pressure turbine is then exhausted into the main condenser.

Steam is extracted from points on the turbine for feedwater heating. This preheating of condensate and reactor feedwater maximizes the plant's overall thermal efficiency. During normal operation, steam is also supplied to the reactor feed pump turbines from the outflow of the MSRs.

During startup and shutdown, steam pressure control is provided by turbine bypass valves that provide a flow path from the main steam manifold to the condenser. During normal operations, steam pressure control for the turbine-generator is provided by an electro-hydraulic control (EHC) system that controls the speed, load, pressure, and flow for startup and planned operation and also trips the unit when required. The EHC system operates the high-pressure stop valves, bypass valves, control valves, low-pressure (intermediate) stop and intercept valves, and other protective devices. Each valve is provided with an individual valve actuator, which eliminates the need for extensive high-pressure control oil piping. The unitized actuator is a self-contained, electro-hydraulic valve positioner that converts the electrical control signals to valve position. Each unitized actuator has two accumulators that store enough hydraulic energy to stroke each valve approximately three times. Each unitized actuator has an oil cooler that is supplied by the turbine building closed cooling water system.

Gland sealing steam prevents air leakage into, or radioactive steam leakage out of, the main turbine. The main turbine gland sealing system is designed to seal the shaft glands and valve stems (high-pressure stop, control, low-pressure stop, intercept, and bypass valves) for the main turbine and reactor feed pump turbines. The system consists of a startup steam supply from the 52-inch manifold or from the auxiliary boiler, steam seal pressure regulators, steam seal header (normal operation supply), one full-capacity gland steam condenser, two full-capacity exhauster blowers, and the associated piping, valves, and instrumentation. The gland steam condenser, which is cooled by main condensate flow, condenses the gland steam and returns it to the main condenser, while allowing saturated air and noncondensable gases to be drawn out by the exhauster.

Turbine-generator bearings are lubricated by a conventional pressurized oil system. Two 100-percent electric (ac) motor-driven pumps supply bearing oil to the turbine generator under normal operation. Normally one ac pump is running and one is a spare. One electric (dc) motor-driven backup pump is provided in the event both ac pumps fail as a result of a loss of ac power. The system also cools and lubricates the turning gear for the main turbine and supports the reactor feed pump and reactor feed pump turbine by providing purification and makeup to the reactor feed pump turbine oil reservoirs.

During normal operations, the generator casing contains a hydrogen atmosphere to increase generator efficiency, and the hydrogen is circulated through the generator casing to remove heat from the generator rotor and stator. Hydrogen cooling is provided by the general service water system. The generator shaft seals are oil-sealed to prevent hydrogen leakage and air in-leakage. The turbine building closed cooling water system provides cooling for the hydrogen seal oil coolers as well as the stator winding coolers, which remove heat from the main generator stator bars.

Other auxiliary systems support gas supplies to the generator and provide steam to heat the high pressure turbine flange during startup (flange heating is not normally used). Drains lines and associated components are provided for the main steam manifold, steam chests, high-pressure loop piping, gland steam supply, and the flange heating exhaust. Low-pressure exhaust hood sprays located just downstream from the last-stage blades of the turbine provide exhaust hood overheating protection.

Nonsafety-related piping components of the system support the operation of turbine first-stage pressure transmitters of the reactor protection system that initiate the automatic bypass of the turbine control valve fast closure and turbine stop valve closure scrams when the first-stage pressure is below a preset fraction of rated pressure.

In addition to its intended function for 10 CFR 54.4(a)(2), the main turbine generator and auxiliaries have the following intended function for 10 CFR 54.4(a)(2).

- Support operation of the RPS turbine first-stage pressure transmitters.

UFSAR References: Sections 10.1, 10.2, 10.3.1, 10.4.3, and 10.4.4

Condenser and Auxiliaries

The purpose of the condenser and auxiliaries system (system code N61) is to provide the heat sink for the turbine exhaust steam, turbine bypass steam, and other turbine cycle flows and to receive and collect flows for return to the nuclear steam supply system. The condenser provides a sufficient volume of condensate for the condensate system pump suction. The condenser and auxiliaries system consists of the main condenser, mechanical vacuum pumps, steam-jet air ejectors, and associated piping, piping components and valves. The system also includes vacuum breakers for the main condenser.

During plant operation, steam from the last stage of the low-pressure turbine is exhausted directly downward into the condenser shell through exhaust openings in the bottom of each of the three turbine casings and is condensed. The main condenser is a single-pressure, single-shell, single-pass, deaerating-type condenser with divided water boxes serving three double-flow, low-pressure turbines. The condenser also serves as a heat sink for several other flows: the two reactor feed pump turbine exhausts, cascading heater drains, steam line drains, pump vents and recirculation lines, heater vents, and condensate system makeup.

The condenser is cooled by the circulating water system (system code N71), which removes the heat rejected to the condenser. The condensate is pumped from the condenser hotwell by the condenser pumps (system code N20) and is returned to the feedwater and steam cycle.

During startup, mechanical vacuum pumps are used to remove the air and offgases from the main condenser. The discharge from the vacuum pumps is routed to the reactor building vent stack via the two-minute holdup pipe. The offgases from the vacuum pump are discharged directly to the environment. This is acceptable because the vacuum pumps are in service when little or no radioactive gases are present. The mechanical vacuum pumps are supported by a seal water system and a lube oil system.

When suitable steam is available, after vacuum has been established in the main condenser by the mechanical vacuum pumps, the steam-jet air ejectors are put into service to remove the gases from the main condenser. Main steam is supplied as the driving medium to the two-stage air ejectors. The first stages take suction from the main condenser and exhaust the gas vapor mixture to the intercondensers. The second stages exhaust the suction gas vapor mixture from the intercondensers to the offgas system (system code N62). The steam-jet intercondensers are drained back to the main condenser.

The condenser and auxiliaries system also includes components that support the supply and exhaust of steam for the reactor feed pump turbines.

UFSAR References: Sections 10.4.1 and 10.4.2

Circulating Water

The purpose of the circulating water system (system code N71) is to supply the main condenser with the necessary cooling water to condense steam from the low pressure turbines. Circulating water pumps located in the circulating water pump house take water from the circulating water reservoir through intake screens and pump it through the condenser to the cooling towers. The system includes the five circulating water pumps, the waterbox drain down pumps, and associated valves, piping and instrumentation.

A makeup water system replaces the circulating water losses caused by evaporation and blowdown. Makeup water is fed into the circulating water system from the GSW system discharge or from the circulating water makeup pumps (normal and standby), which are components in the GSW system.

UFSAR References: Sections 9.2.1.2 and 10.4.5

Drips, Drains and Vents

The purpose of the drips, drains and vents system (system code P95) is to provide drainage for equipment in the steam and power conversion systems, including the main steam manifold, steam chest, high and low pressure turbines, moisture separator/reheaters, reactor feedwater pump turbines, and interconnecting piping drains. Drainage from this equipment is routed to the condenser.

The system also handles drainage from safety-related equipment including the main steam lines and the HPCI and RCIC steam lines. Drainage from the main steam lines is collected by the nuclear boiler system, which includes the safety-related primary containment isolation valves, before it is delivered to nonsafety-related drips, drains and vents system. Drainage from the HPCI and RCIC steams lines is also routed to the nonsafety-related drips, drains and vents system. Ultimately, drainage from these systems is routed to the condenser.

UFSAR References: None

UFSAR References

The following table lists the UFSAR references for systems described in this section.

System Number	System	UFSAR Reference
N11	Main and Reheat Steam	Sections 6.2.6, 10.3 and 10.4.4
N20	Condensate	Sections 10.4.6 and 10.4.7
N22	Heater Drains	Section 10.4.7.2
N30	Main Turbine Generator and Auxiliaries	Sections 10.1, 10.2, 10.3.1, 10.4.3, and 10.4.4
N61	Condenser and Auxiliaries	Sections 10.4.1 and 10.4.2
N71	Circulating Water	Sections 9.2.1.2 and 10.4.5
P95	Drips, Drains and Vents	None

Components Subject to Aging Management Review

For each safety-to-nonsafety interface, nonsafety-related components connected to safety-related components were included up to one of the following:

(1) The first seismic anchor, which is defined as a device or structure that ensures that forces and moments are restrained in three orthogonal directions.

(2) An equivalent anchor (restraints or supports), which is defined as a boundary point that encompasses at least two supports in each of three orthogonal directions.

(3) A boundary determined using the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a flexible connection or the end of a piping run (such as a vent or drain line) or up to and including a base-mounted component.

(4) If the boundary could not be determined in accordance with (1), (2), or (3) above, then the boundary beyond the interface was determined from review of site-specific supporting analyses.

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 10 CFR 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 2.3.4-3-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 3.4.2-3-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.

System Number	System	Component Types	AMR Results
N11	Main and Reheat Steam	Table 2.3.4-3-1	Table 3.4.2-3-1
N20	Condensate	Table 2.3.4-3-2	Table 3.4.2-3-2
N21	Feedwater and Standby Feedwater	Table 2.3.4-3-3	Table 3.4.2-3-3
N22	Heater Drains	Table 2.3.4-3-4	Table 3.4.2-3-4
N30	Main Turbine Generator and Auxiliaries	Table 2.3.4-3-5	Table 3.4.2-3-5
N61	Condenser and Auxiliaries	Table 2.3.4-3-6	Table 3.4.2-3-6
N71	Circulating Water	Table 2.3.4-3-7	Table 3.4.2-3-7
P11	Condensate Storage and Transfer	Table 2.3.4-3-8	Table 3.4.2-3-8
P95	Drips, Drains and Vents	Table 2.3.4-3-9	Table 3.4.2-3-9

License Renewal Drawings

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

System Code	System	LRA Drawings	
N11	Main and Reheat Steam	LRA-M-2002 LRA-M-2003	
N20	Condensate	LRA-M-2004 LRA-M-2004-1 LRA-M-2006	LRA-M-2011 LRA-M-2011-1
N21	Feedwater and Standby Feedwater	LRA-M-2002 LRA-M-2003 LRA-M-2004 LRA-M-2004-1	LRA-M-2023 LRA-M-2985-1 LRA-M-5083
N22	Heater Drains	LRA-M-2004-1 LRA-M-2005 LRA-M-2005-1	
N30	Main Turbine Generator and Auxiliaries	LRA-I-2336-05 LRA-I-2336-06 LRA-I-2336-26 LRA-I-2346-05 LRA-M-2002 LRA-M-2003	LRA-M-2005 LRA-M-2005-1 LRA-M-2008-1 LRA-M-2010 LRA-M-2042 LRA-M-2985
N61	Condenser and Auxiliaries	LRA-M-2002 LRA-M-2004 LRA-M-2017-1	
N71	Circulating Water	LRA-M-2007	
P11	Condensate Storage and Transfer	LRA-M-2006 LRA-M-2011-1 LRA-M-2678	
P95	Drips, Drains and Vents	LRA-M-2004-1 LRA-M-2985 LRA-M-2985-1	LRA-M-2035 LRA-M-2043

Table 2.3.4-3-1
Main and Reheat Steam System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Coil	Pressure boundary
Flow element	Pressure boundary
Flex connection	Pressure boundary
Piping	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.4-3-2
Condensate System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Chamber	Pressure boundary
Cooler housing	Pressure boundary
Flow element	Pressure boundary
Expansion joint	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Filter housing	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.4-3-3
Feedwater and Standby Feedwater System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Accumulator	Pressure boundary
Bolting	Pressure boundary
Flow element	Pressure boundary
Eliminator	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Rupture disc	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Turbine housing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.4-3-4
Heater Drains System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Flow element	Pressure boundary
Filter housing	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.4-3-5
Main Turbine Generator and Auxiliaries System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Accumulator	Pressure boundary
Bolting	Pressure boundary
Condenser shell	Pressure boundary
Cooler housing	Pressure boundary
Cylinder	Pressure boundary
Dryer	Pressure boundary
Flow element	Pressure boundary
Eliminator	Pressure boundary
Expansion joint	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary
Flex connection	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Rupture disc	Pressure boundary
Separator	Pressure boundary
Sight glass	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary

Table 2.3.4-3-5 (Continued)
Main Turbine Generator and Auxiliaries System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Trap	Pressure boundary
Turbine housing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.4-3-6
Condenser and Auxiliaries System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Condenser shell	Pressure boundary
Cooler housing	Pressure boundary
Ejector	Pressure boundary
Expansion joint	Pressure boundary
Filter housing	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Trap	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.4-3-7
Circulating Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Flex connection	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.4-3-8
Condensate Storage and Transfer System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Flex connection	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Trap	Pressure boundary
Valve body	Pressure boundary

a. 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 2.3.4-3-9
Drips, Drains and Vents System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review

Component Type	Intended Function[a]
Bolting	Pressure boundary
Condenser shell	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve body	Pressure boundary

a. 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

The following structures and structural components are within the scope of license renewal.

- Section 2.4.1, Reactor/Auxiliary Building and Primary Containment
- Section 2.4.2, Water-Control Structures
- Section 2.4.3, Turbine Building, Process Facilities and Yard Structures
- Section 2.4.4, Bulk Commodities

2.4.1 Reactor/Auxiliary Building and Primary Containment

Description

The reactor/auxiliary building houses the primary containment structure. This section includes a discussion of both structures.

Reactor/Auxiliary Building

The purpose of the reactor building, in conjunction with the reactor building heating and ventilating system and standby gas treatment system, is to serve as primary containment during reactor refueling and maintenance operations when the primary containment is open and a secondary containment barrier when the primary containment is functional. The primary purposes of the secondary containment are to minimize ground-level release of airborne radioactive materials and to provide means for a controlled release of the building atmosphere. The reactor portion of the reactor/auxiliary building is referred to as the reactor building, and the auxiliary portion is referred to as the auxiliary building.

The reactor/auxiliary building is a rectangular, reinforced concrete structure founded on bedrock with an upper steel superstructure. The reactor building completely encloses the primary containment, which comprises the drywell, suppression chamber, and connecting suppression vent system. The reactor building also houses the refueling and reactor servicing equipment, biological shield, new and spent fuel storage facilities, and other reactor auxiliary or service equipment.

Reactor Building

The reactor building structure is Category I, constructed of monolithic reinforced concrete floors and walls to the refueling level all supported on the reactor building foundation mat founded on bedrock. A reinforced-concrete pad, integral with the basemat and centered under the reactor pressure vessel (RPV), supports the biological shield, drywell, reactor support pedestal, and all other structures internal to the containment. The substructures and exterior walls of the building up to the refueling floor consist of poured-in-place reinforced concrete. These exterior walls of the reactor building provide tornado missile protection. Above the level of the refueling floor, the building structure is steel-framed with insulated metal siding with sealed joints. The metal siding and roof decking above the refueling floor are designed to release (blow away) during the design-basis tornado, while the remainder of the exposed frame is designed for the full tornado load. The structural steel includes floor framing steel for platforms and a catwalk outside the suppression chamber. The reactor building roof has a pitch and slag roof over insulated metal decking. The reactor building has access openings from the auxiliary building and the outside for personnel and equipment. Interlocked doors with weather-strip-type seals provide access from the outside.

The biological shield wall, enclosed by the reactor building, serves as a radiation shield around the drywell. It also functions as a mechanical barrier for the protection of the containment against missiles that may be generated external to the primary containment. The biological shield is a reinforced concrete structure extending from the bottom of the drywell to the refueling floor and completely encasing the drywell structure. The top of the shield consists of a removable, segmented reinforced concrete plug. The biological shield wall resists deformation and buckling of the drywell walls over areas where the biological shield wall is in contact with the drywell. A gap filled with a compressible material separates the upper portion of the drywell from the biological shield wall reinforced concrete. The biological shield wall also supports the various reactor building floor elevations that frame into it and resists the earthquake-induced forces that act on the RPV and sacrificial shield wall transferred to it through the earthquake-stabilizer truss system.

The reactor building includes portions of the tunnel containing the outboard main steam isolation valves (MSIVs), the main steam lines up to the turbine building, the feedwater lines, and the outboard feedwater line isolation valves. The reinforced-concrete steam tunnel walls, floor, and roof protect the equipment outside the tunnel from the effects of a postulated steam line break within the tunnel. This tunnel, which also runs through the auxiliary building, is equipped with hinged doors which, upon pressure buildup due to a break in one of these lines, will relieve the steam pressure to the first and second floors of the turbine building.

The spent fuel storage pool, dryer-separator pool, skimmer surge tanks, and reactor refueling pool located in the reactor building are reinforced concrete structures completely lined with seam-welded stainless steel plate. The stainless steel liners prevent leakage. There are no connections between the reactor well and the fuel storage pool that would allow the fuel storage pool to be drained below the pool grade. Channels are located in the concrete directly behind the welded seams of the pool liners, and these are monitored to detect leakage from the pools. A special storage area is provided in the spent fuel pool to accommodate the spent fuel shipping cask. The purpose of the Category I spent fuel pool is to provide a storage place for irradiated fuel and other radioactive equipment requiring shielding and to provide an area for performing work on selected radioactive equipment. Stainless steel high-density fuel storage racks are provided for the fuel assemblies (see Section 2.3.3.4, Fuel Pool Cooling and Cleanup).

The new fuel storage vault is integral with the reactor building concrete and provides for storage of new fuel. The new fuel storage vault is designed to preclude flooding of the new fuel assemblies. The vault is closed at the top by a shield plug that extends above the refueling floor. The shield plug is divided into five sections, each with redundant lifting rings.

The reactor building crane runway and supporting structure are designed as an integral part of the building superstructure. Restraints are provided on the crane bridge and trolley to prevent either from leaving their respective rails due to horizontal and vertical displacement in the event of a design-basis earthquake.

The Category II/I refueling platform is used as the principal means of transporting fuel assemblies between the reactor well and the fuel storage pool. The platform travels on tracks extending along each side of the reactor well and the fuel storage pool. The platform supports the refueling grapple and auxiliary hoists.

The railroad bay airlock, a Category I structure with concrete walls and roof, is located adjacent to the south side of the reactor building and provides a protected secondary containment access point for large equipment. The railroad bay airlock consists of a pair of swing doors at the exterior and a pair of swing doors between the airlock and the reactor building. The railroad bay entry (exterior) doors have inflatable seals which provide for air tightness as well as flood protection. The doors provide primary containment during reactor refueling and maintenance operations when the primary containment system is open. The entry doors and railroad bay rail pockets have seals which provide for air tightness as well as flood protection. The railroad bay entry doors are not fire rated; however, they are credited to perform a fire barrier function. The railroad bay entry doors ensure that a fire originating outside the plant will not propagate into the reactor building via the railroad bay. The purpose of the railroad bay airlock is to provide equipment access during major maintenance activities and to maintain secondary containment integrity.

Auxiliary Building

The purpose of the auxiliary building is to support the standby gas treatment exhaust stack located on the roof and house major plant systems and components.

The auxiliary building is a reinforced concrete structure supported on a reinforced-concrete mat foundation founded on bedrock. The exterior walls provide tornado missile protection. The main steam tunnel passes through this building. Typical auxiliary building walls, floors, and roof are constructed of poured-in-place reinforced concrete. A seismic Category II/I steel frame penthouse with steel siding walls is constructed on the auxiliary building roof to house the exhaust stack for the ventilation equipment located in the auxiliary building. The roof also provides support for the standby gas treatment system (SGTS) carbon steel exhaust stack and the hardened vent exhaust stack.

The reactor/auxiliary 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), and for station blackout (10 CFR 50.63). [10 CFR 54.4(a)(3)]

- Provide radiation-shielding barriers to limit off-site radiation exposure. [10 CFR 54.4(a)(2)]
- Provide secondary containment to limit the release of radioactive materials so that off-site doses from a postulated design basis accident are below the limits of 10 CFR 50.67 or 10 CFR 100. [10 CFR 54.4(a)(1)]
- Provide a containment barrier 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. [10 CFR 54.4(a)(1)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]

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 and control room occupant doses do not exceed the limits of 10 CFR 50.67 or 10 CFR 100 and serve as a heat sink during a design basis event. The steel primary containment is a General Electric Mark I low-leakage pressure suppression containment design consisting of a drywell, torus (or suppression chamber), and connecting vent system, and houses the RPV, recirculation system, and other primary components.

Drywell

The drywell is a steel pressure vessel with a spherical lower section, a cylindrical upper section, and a removable, flanged, hemi-ellipsoidal top head. During the erection process, the drywell was supported by a temporary construction skirt anchored to the drywell pedestal. Openings in the skirt permit proper placing of concrete fill between the structural concrete pedestal and the drywell bottom. The drywell pedestal that supports the drywell is founded on the foundation slab of the reactor building.

The drywell is enclosed in the reinforced concrete biological shield wall. The bottom portion of the drywell shell is totally embedded in concrete. Above the foundation transition zone of the drywell shell and concrete, the drywell is separated from the reinforced concrete biological shield wall by a gap of approximately two inches. This gap is filled with a compressible polyurethane material to allow for movement between the drywell and concrete. The polyurethane material is coated on both sides with an epoxy resin binder to prevent water leakage into the foam. The lower portion of the transition zone, also known as the sand pocket region, is backed by compacted sand to aid in condensation drainage. There are four drain lines to remove moisture from the sand cushion in case of condensation drainage into the gap between the drywell and biological shield wall. Removable, segmented, concrete shield plugs provide shielding over the top of the drywell. The exposed interior surfaces of the drywell pressure boundary are coated to protect steel surfaces from corrosion and to facilitate decontamination. A drywell head, one double-door air lock, two bolted equipment hatches, and a bolted CRD removal hatch provide access to the drywell. The hatches have double testable seals and are bolted in place. The locking mechanism on each air-lock door is designed to maintain a tight seal when the doors are subject to either external or internal pressure. The doors are mechanically interlocked so that neither door can be operated unless the other door is closed and locked. The drywell head and hatch cover are bolted in place and sealed with gaskets.

The containment internal structures are Category I structures. They are mostly heavily reinforced-concrete walls and slabs, with the exception of structural steel flooring or truss systems. They are designed to support the principal nuclear steam supply equipment and the several floor levels within the containment. The internal structures include the sacrificial shield wall, reactor pedestal, drywell floor, gallery floor levels, earthquake-stabilizer truss system, and pipe-break-support truss system.

The sacrificial shield wall is a composite structural steel and concrete open-ended cylindrical shell placed concentric to the RPV vertical centerline. It functions as a radiation and heat barrier between the RPV and the primary steel containment wall. The sacrificial shield wall has steel plates on its exterior and interior surfaces and is stiffened meridionally by vertical steel columns. The steel plates are welded to the flanges of the columns, and the annular space between the plates is filled with concrete. Openings are provided in the sacrificial shield wall for the passage of lines from the RPV to the drywell. Those openings, which lie within an area nine feet above and sixteen feet below the centerline of the core, are required to be shielded and are equipped with shielding doors. These doors are locked and will not open during a pipe break within the annulus. Other openings above and below this band have no shielding requirements but are covered with a light-weight rupture diaphragm designed to help relieve the annulus pressure should a break occur. The sacrificial shield wall is rigidly attached at the bottom to the reactor support pedestal; the top is free to displace in all directions, except tangential. An earthquake-stabilizer truss system restrains tangential displacement.

The reactor pedestal supports the RPV, sacrificial shield wall, and pipe whip restraints, which are attached to the pedestal, either directly or indirectly through a pipe-break-support truss system. The pedestal is a reinforced concrete cylindrical shell integral with the drywell floor. The RPV ring girder is bolted to a ring plate and then anchored to the top of the reactor pedestal with anchor bolts.

The drywell floor slab is a reinforced concrete pad poured on the bottom of the drywell. It is connected to the basemat by special shear keys. The shear keys have anchors attached to them to transfer the uplift forces to the basemat. The main functions of the drywell floor are to act as a foundation for the reactor support pedestal within the drywell and to support the drywell itself.

There are two gallery floor levels within the drywell. The gallery levels consist of radial steel beams; the lower gallery is supported by the reactor pedestal, and the upper by the sacrificial shield.

The earthquake-stabilizer truss system is a structural steel truss constructed at the top elevation of the sacrificial shield wall. The earthquake stabilizer truss system stabilizes the RPV and sacrificial shield wall under earthquake excitation by transferring the earthquake-induced forces to the concrete biological shield wall. The RPV is connected to the sacrificial shield wall, and the sacrificial shield wall, in turn, is connected to the drywell shell by a steel truss arrangement.

A structural steel pipe-break-support truss system is provided to carry those pipe restraints that cannot be carried by the drywell shell. The sacrificial shield wall, reactor pedestal, drywell floor slab, or any combination thereof supports the truss system.

Supports for the CRD housings that are attached to the bottom of the reactor vessel are located within the drywell under the RPV. The CRD housing supports are horizontal beams installed immediately below the bottom head of the RPV, between the rows of CRD housings. The beams are bolted to brackets welded to the steel form liner of the drive room in the reactor support pedestal. Drywell and equipment sumps are provided at the bottom of the drywell to collect and drain waste liquids.

Two general types of pipe penetrations are provided: those that must accommodate thermal movement are sleeved penetration assemblies, and those that experience relatively little thermal stress are unsleeved penetration assemblies. For sleeved penetrations, bellows-type expansion joints are used to accommodate relative or thermal movement. For this type of joint, the penetration sleeve passes through concrete and is welded to the primary containment vessel reinforcement plate. A guard pipe surrounds the process line and is designed to protect the bellows and maintain the penetration. Insulation and air gaps reduce thermal stresses, limit the radial heat flow resulting from convection and radiation from the pipe penetration, and keep the temperature of the concrete adjacent to the sleeve below 150°F. Also, penetrations accommodating hot pipes feature cooling coils on the guard pipe.

Unsleeved penetrations are used for low-temperature pipelines that contain fluids whose temperature is 150°F or less, and that do not require anchorage to the biological shield wall.

Electrical conductors penetrating the biological shield and primary containment pass through the penetrations that are mounted in steel pipe sleeves. The sleeves are welded to the primary containment vessel.

Seven traversing in-core probe (TIP) penetrations (five for guide tubes and two spares) pass from the reactor building through the primary containment. Penetrations of the insertion guide tubes through the primary containment are sealed.

Exposed interior surfaces of the drywell pressure boundary steel and structural steel, including the drywell jet deflectors, and concrete surfaces are coated. The function of the coating system is to protect the surfaces from corrosion; from attack by aggressive water, radioactive water, or radiation contamination; and to facilitate washdown.

Torus (or Suppression Chamber)

The torus (or suppression chamber) is a toroidal leaktight steel pressure vessel situated below and encircling the drywell. The torus comprises a series of segmented welded mitered cylinders that form a circular configuration with internal steel framing and access hatches. The torus shell is reinforced at each mitered joint by a T-shaped ring beam. The ring beam is braced laterally with stiffeners connecting the ring beam web to the torus shell. The torus is supported vertically at each mitered joint location by inside and outside columns and by a saddle support that spans the inside and outside columns. The column base plates rest on a Lubrite pad and are free to slide and compensate for the overall expansion of the torus. The anchorage of the torus to the basemat is achieved by a system of base plates, stiffeners, and anchor bolts located at each column and at two locations on each saddle support. Access to the interior of the torus is provided at two locations. Each location has a manway entrance with a double-gasketed bolted cover connected to the torus by a large diameter steel pipe. The double seals are provided with a leakage test tap by which the enclosed space between the seals is pressurized to containment design pressure to test for leakage through the seal when the cover is bolted in place. Externally, access to the torus is provided by maintenance platforms and walkways. The interior surfaces of the torus, ring girders, catwalks, monorail, stiffeners, supporting steel, piping, hangers, and penetration nozzles are coated. The torus includes penetrations for electrical and mechanical components as needed. The coating is a water-resistant phenolic coating cross-linked with epoxy resin and polymerized with an alkaline curing agent. The function of this coating is to provide protection from corrosion and radiation contamination and to facilitate washdown.

Vent System

The vent system connects the drywell to the torus to conduct flow from the drywell to the torus. A total of eight circular vent pipes form the connection between the drywell and the torus. Jet deflectors are provided in the drywell at the inlet end of each vent pipe to prevent possible damage to the vent pipes from jet forces accompanying a pipe break inside the drywell. The vent pipes are enclosed in sleeves and provided with expansion joints to accommodate differential motion between the drywell and the torus. The drywell vents are connected to a torus-shaped ring header placed within the air space of the torus. The interior and exterior surfaces of the downcomers and vent header, the exterior surfaces of the vent pipes, and vent header supports are coated. The coating is a water-resistant phenolic coating cross-linked with epoxy resin and polymerized with an alkaline curing agent. The function of this coating is to provide protection from corrosion and radiation contamination and to facilitate washdown.

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 loss of coolant accident so that offsite and control room occupant doses do not exceed the limits of 10 CFR 50.67 or 10 CFR 100. [10 CFR 54.4(a)(1)]

- 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 EQ (10 CFR 50.49). [10 CFR 54.4(a)(3)]

- Provide heat sink for any postulated transient or accident condition in which the normal heat sink (main condenser or shutdown cooling system) is unavailable. [10 CFR 54.4(a)(1)]

- Provide sufficient water to supply emergency core cooling system (ECCS) requirements and to refill the spent fuel pool if normal makeup is not available. [10 CFR 54.4(a)(1)]

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]

UFSAR References

Reactor/Auxiliary Building

Section 3.4.4.1	Figure 3.8-1	Figure 3.8-28
Section 3.8.4.1.1	Figure 3.8-2	Figure 3.8-29
Section 6.2.1.2.2.1	Figure 3.8-3	Figure 3.8-30
Section 6.2.1.6	Figure 3.8-4	Figure 3.8-31
Section 9.1.4.2.7	Figure 3.8-5	Figure 3.8-32
	Figure 3.8-6	Figure 3.8-40
	Figure 3.8-27	Figure 3.8-41

Primary Containment Structure

Section 3.8.2	Figure 3.8-1	Figure 3.8-7
Section 3.8.3	Figure 3.8-2	Figure 3.8-23
Section 6.2.1.6	Figure 3.8-3	Figure 3.8-24
	Figure 3.8-4	Figure 3.8-25
	Figure 3.8-5	Figure 3.8-26
	Figure 3.8-6	

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 reactor/auxiliary 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 in Section 2.4.4, Bulk Commodities.

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.

Table 2.4-1
Reactor/Auxiliary Building and Primary Containment Components Subject to Aging Management Review

Component	Intended Function[a]
Steel and Other Metals	
Control room ceiling support system	Support for Criterion (a)(2) equipment
CRD housing support steel	Support for Criterion (a)(1) equipment
Drywell personnel access airlock, equipment hatch, CRD hatch	Enclosure, protection Missile barrier Pressure boundary Support for Criterion (a)(1) equipment
Drywell personnel access airlock, equipment hatch, CRD hatch: locks, hinges, and closure mechanisms	Enclosure, protection Pressure boundary Support for Criterion (a)(1) equipment
Drywell personnel airlock, equipment hatch, CRD hatch, torus manway and drywell head pressure retaining bolting	Pressure boundary Support for Criterion (a)(1) equipment
Drywell shell or torus deflectors	Enclosure, protection Missile barrier Support for Criterion (a)(1) equipment
Drywell sump liner	Enclosure, protection Support for Criterion (a)(1) equipment
Earthquake-stabilizer truss system	Support for Criterion (a)(1) equipment
Hardened vent stack	Support for Criterion (a)(2) equipment
Metal siding	Enclosure, protection Pressure boundary Pressure relief
Penetration bellows	Pressure boundary Support for Criterion (a)(1) equipment
Pressure relief doors in steam tunnel	Pressure relief Support for Criterion (a)(1) equipment
Primary containment electrical penetration sleeves	Pressure boundary Support for Criterion (a)(1) equipment
Primary containment mechanical penetration sleeves	Pressure boundary Support for Criterion (a)(1) equipment

**Table 2.4-1 (Continued)
Reactor/Auxiliary Building and Primary Containment
Components Subject to Aging Management Review**

Component	Intended Function[a]
Railroad airlock doors	Enclosure, protection Fire barrier Flood barrier Pressure boundary Support for Criterion (a)(1) equipment
RCIC blow-off hatch	Pressure relief Support for Criterion (a)(1) equipment
Reactor building crane; rails and structural girders	Support for Criterion (a)(2) equipment
Reactor building sump liner	Enclosure, protection Support for Criterion (a)(1) equipment
Reactor cavity liner	Enclosure, protection Support for Criterion (a)(1) equipment
Reactor vessel support assembly	Support for Criterion (a)(1) equipment
Refueling bellows assembly	Enclosure, protection Flood barrier Support for Criterion (a)(2) equipment
Refueling platform equipment assembly and rails	Support for Criterion (a)(2) equipment
Roof decking	Enclosure, protection Pressure boundary
Sacrificial shield wall (steel portion including shielding doors)	Enclosure, protection Missile barrier Support for Criterion (a)(2) equipment
SGTS exhaust stack	Support for Criterion (a)(2) equipment
Shield plug	Enclosure, protection
Skimmer surge tank	Support for Criterion (a)(2) equipment
Spent fuel storage pool liner plate	Enclosure, protection Support for Criterion (a)(1) equipment
Spent fuel storage pool gates	Enclosure, protection Support for Criterion (a)(1) equipment

Table 2.4-1 (Continued)
Reactor/Auxiliary Building and Primary Containment
Components Subject to Aging Management Review

Component	Intended Function[a]
Steel components: beams, columns, plates	Enclosure, protection Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Steel components: monorails	Support for Criterion (a)(2) equipment,
Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket region	Enclosure, protection Missile barrier Pressure boundary Support for Criterion (a)(1) equipment
Steel elements (inaccessible areas): drywell shell; drywell shell in sand pocket region	Enclosure, protection Missile barrier Pressure boundary Support for Criterion (a)(1) equipment
Steel elements: drywell support skirt	Support for Criterion (a)(1) equipment
Steel elements: torus ring girders, downcomers	Support for Criterion (a)(1) equipment
Steel elements: torus shell	Heat sink Pressure boundary Support for Criterion (a)(1) equipment
Steel elements: torus shell (inaccessible areas)	Heat sink Pressure boundary Support for Criterion (a)(1) equipment
Steel elements: torus; vent line; vent header; vent line bellows; downcomers	Pressure boundary Support for Criterion (a)(1) equipment
Steel elements: vent line bellows	Pressure boundary Support for Criterion (a)(1) equipment
Torus electrical penetration sleeves	Pressure boundary Support for Criterion (a)(1) equipment
Torus external supports (columns, saddles)	Support for Criterion (a)(1) equipment
Torus manway covers	Pressure boundary Support for Criterion (a)(1) equipment

Table 2.4-1 (Continued)
Reactor/Auxiliary Building and Primary Containment
Components Subject to Aging Management Review

Component	Intended Function[a]
Torus mechanical penetrations sleeves	Pressure boundary Support for Criterion (a)(1) equipment
Vent header support	Support for Criterion (a)(1) equipment
Concrete	
Biological shield wall	Enclosure, protection Missile barrier Support for Criterion (a)(1) equipment
Concrete (accessible areas): interior and above-grade exterior	Enclosure, protection Flood barrier Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Concrete (accessible areas): exterior above- and below-grade; foundation	Enclosure, protection Flood barrier Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Concrete (inaccessible areas): below-grade exterior; foundation	Enclosure, protection Flood barrier Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Drywell floor slab	Support for Criterion (a)(1) equipment
Masonry walls	Enclosure, protection Fire barrier Pressure boundary Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Reactor pedestal	Support for Criterion (a)(1) equipment

Table 2.4-1 (Continued)
Reactor/Auxiliary Building and Primary Containment
Components Subject to Aging Management Review

Component	Intended Function[a]
Shield plugs	Enclosure, protection Support for Criterion (a)(1) equipment
Steam tunnel	Missile barrier Pressure boundary Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Other Materials	
Compressible seals for drywell personnel access airlock, equipment hatch, CRD hatch, equipment hatch, torus manway covers	Pressure boundary Support for Criterion (a)(1) equipment
Moisture barrier	Enclosure, protection Support for Criterion (a)(1) equipment
Primary containment electrical penetration seals and sealant	Pressure boundary Support for Criterion (a)(1) equipment
Service Level I coatings	Support for Criterion (a)(2) equipment
Spent fuel storage pool gates rubber gasket/ seal	Enclosure, protection Support for Criterion (a)(1) equipment

a. Intended functions are defined in Table 2.0-1.

2.4.2 Water-Control Structures

Description

The water-control structures consist of the general service water pump house (GSWPH), residual heat removal complex, and shore barrier.

General Service Water Pump House

The purpose of the GSWPH is to prevent fire from damaging both fire protection pumps and to house the circulating water make-up pumps, GSW pumps, and associated electrical equipment.

Located south of the technical support center, the GSWPH sits on the west shore of Lake Erie, on the intake canal that served Fermi 1. The structure consists of a metal-clad steel building founded on a reinforced concrete intake structure with concrete and concrete block interior walls. Traveling screens and stationary racks are provided to keep floating debris from entering the GSW intake pit. The GSWPH structure houses five GSW pumps, two circulating water reservoir makeup pumps, two fire protection pumps, and a jockey pump. One fire protection pump is driven by a diesel engine, and the other by an electric motor. The diesel-driven pump is located in a cubicle surrounded by a 3-hour fire rated barrier with fire doors. The fuel tank for the diesel engine is located outside, at grade, adjacent to the north wall of the building housing the fire protection pumps.

The GSWPH has no intended function for 10 CFR 54.4(a)(1) or (a)(2).

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

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for fire protection (10 CFR 50.48).

Residual Heat Removal Complex

The purpose of the residual heat removal (RHR) complex is to provide a source of cooling water for safe shutdown of the plant.

The RHR complex, which is the ultimate heat sink, is located west of the reactor building and is a Category I structure consisting of the RHR service water system, the emergency equipment service water system, the diesel generator service water system, the mechanical draft cooling towers, the emergency alternate current (AC) power system (diesel generators), and the reservoir. The RHR complex is a reinforced concrete and concrete block structure, supported on a base mat. Rated walls, floors, and ceilings are constructed of reinforced concrete having a fire resistance rating of three hours. Doors in rated walls are fire doors. Penetrations in rated walls, floors, and ceilings are sealed. Ducts or openings penetrating rated walls are provided with fire dampers. The RHR complex is divided into two divisions. Each division has the capacity to safely shut down the reactor during normal and accident conditions. Each division of the complex is provided with full-size vertical pumps and a separate reinforced concrete pump house. The pumps and pump houses are Category I construction. Column bracing is provided as required to limit stress to allowable values.

Cooling Towers

A two-cell, mechanical induced-draft cooling tower is located over each division reservoir of the RHR complex. The towers are of Category I fireproof construction with reinforced concrete shells, cement board fill, and mist eliminators. The cooling fan motor is enclosed in a concrete cubicle designed to repel missiles, and missile shields protect the cooling fan gear hub and shaft. The purpose of each tower is to provide cooling for one division of the plant load (one RHR heat exchanger, one emergency equipment cooling water system heat exchanger, and two emergency diesel generators), thus providing complete redundancy.

RHR Complex Reservoir

The RHR complex reservoir consists of two one-half-capacity reinforced concrete structures of Category I construction, founded on bedrock and located in the lower bay area of the RHR complex, each with a capacity of 3.41×10^6 gallons of water at elevation 583 feet. In the event of a mechanical failure in one of the RHR divisions, the reservoirs are connected by lines with redundant valves to permit access to the combined inventory of the two reservoirs from either RHR division.

RHR Pumphouse

The RHR pumphouse is a Category I structure constructed integrally with the RHR complex. Each division of the complex is provided with full-size vertical pumps and a separate reinforced concrete pump house. Column bracing is provided as required to limit stresses.

Emergency Diesel Generators

Four emergency diesel generators (EDG), part of the RHR complex, are located on the first floor level of the multi-level complex. Each EDG is housed in a separate individual room. Walls isolating the EDGs provide fire and missile protection. Independent fire detection and automatic fire-fighting systems are provided for each EDG. The EDG fuel oil storage tanks are located in the RHR complex, each in a separate enclosed room.

The RHR complex has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) or (a)(3).

- Provide physical support, shelter, and protection for safety-related systems, structures, and components. [10 CFR 54.4(a)(1)]
- Provide a source of cooling water for safe shutdown of the plant. The RHR complex is designed to provide a reliable source of cooling water and is the ultimate heat sink as described in the UFSAR. [10 CFR 54.4(a)(1)]
- Provide physical support, shelter, and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1). [10 CFR 54.4(a)(2)]
- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63). [10 CFR 54.4(a)(3)]

Shore Barrier

The purpose of the shore barrier is to protect the shoreline adjacent to the plant from erosion resulting from wave action. The shore barrier preserves the integrity of the plant site fill placed to Elevation 583 feet as well as protecting the main plant portion of the site against wave forces.

The shore barrier, located on the plant's eastern boundary along Lake Erie, is a Category I structure consisting of a rubble-mound structure with an armor cover of stone having a toe elevation of 572.0 feet, a crest elevation of 583.0 feet, and a lake-ward side slope of 2:1 (horizontal to vertical).

The shore barrier has the following intended functions for 10 CFR 54.4(a)(1) and (a)(2).

- Provide physical support, shelter, and protection for safety-related systems, structures, and components. [10 CFR 54.4(a)(1)]
- Provide physical support, shelter, and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1). [10 CFR 54.4(a)(2)]

The shore barrier has no intended functions for 10 CFR 54.4(a)(3).

UFSAR References

GSWPH

Section 1.2.2.15.8.2

Section 9.2.1.2

Section 9A.4.8

RHR Complex

Section 9.2.5	Figure 9A-13	Figure 9A-16
Section 9A.4.3	Figure 9A-14	Figure 9A-17
	Figure 9A-15	Figure 9A-18

Shore Barrier

Section 1.2.2.3.5	Figure 2.4-22
Section 2.4.5.7	
Section 3.4.4.5	
Section 3.7.2.12	

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 in Section 2.4.4, Bulk Commodities.

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.

Table 2.4-2
Water-Control Structures
Components Subject to Aging Management Review

Component	Intended Function[a]
Steel and Other Metals	
Fire protection fuel-oil storage tank support	Support for Criterion (a)(3) equipment
Steel components: beams, columns, plates	Enclosure, protection Heat sink Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Steel components: monorails	Support for Criterion (a)(2) equipment
Steel sheet piles for shore barrier	Flood barrier Support for Criterion (a)(1) equipment
Concrete	
Beams, columns and floor slabs	Enclosure, protection Flood barrier Heat sink Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Concrete (accessible areas): all	Enclosure, protection Flood barrier Heat sink Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Concrete (inaccessible areas): all	Enclosure, protection Flood barrier Heat sink Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

Table 2.4-2 (Continued)
Water-Control Structures
Components Subject to Aging Management Review

Component	Intended Function[a]
Concrete (accessible areas): exterior above- and below-grade; foundation; interior slab	Enclosure, protection Flood barrier Heat sink Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	Enclosure, protection Flood barrier Heat sink Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Exterior concrete roof slabs	Enclosure, protection Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Masonry walls	Enclosure, protection Fire barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
RHR cooling tower fill/mist eliminators	Heat sink
Other Materials	
Barrier stone	Flood barrier Support for Criterion (a)(1) equipment

a. Intended functions are defined in Table 2.0-1.

2.4.3 Turbine Building, Process Facilities and Yard Structures

Description

The following structures are included in this review.

- Turbine Building
- Process Facilities
  - Radioactive Waste Building
- Yard Structures
  - Combustion Turbine Generator No. 11-1 (CTG 11-1) Structure
  - Condensate Storage and Return Tanks Foundations and Retaining Barrier
  - CTG-11 Fuel Oil Storage Tank Foundation
  - Independent Spent Fuel Storage Installation (ISFSI) Rail Transfer Pad
  - Manholes, Handholes and Duct Banks
  - Relay House, 120kV Switchyard
  - Relay House, 345kV Switchyard
  - Transformer and Switchyard Support Structures and Foundations

Turbine Building

The turbine building houses the turbine generator, power conversion equipment, and associated auxiliaries. Also located in the turbine building are equipment for the condenser offgas system, offsite power cables affecting CTG 11-1, and Division I and II cables associated with high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC). The turbine building, located adjacent to and separate from the reactor/auxiliary building, is a nonsafety-related structure.

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 cranes. 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 a foundation that is separate and independent from the foundation mat of the turbine building. The main steam lines to the turbine generator from the reactor are housed in a reinforced concrete tunnel running from the reactor building to the turbine building. The reinforced concrete tunnel walls and roof are designed for radiation shielding. Additionally, a portion of the seismic Category I piping routed from the condensate storage tank to the HPCI and RCIC systems in the reactor building passes through the turbine building basement. The turbine building also prevents waves and wave run-up above the sill elevations on the east wall of the reactor/auxiliary building, thereby preventing flooding of the buildings.

The turbine building has no intended function for 10 CFR 54.4(a)(1).

The turbine building has the following intended functions for 10 CFR 54.4(a)(2) and (a)(3).

- Provide physical support, shelter, and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1). [10 CFR 54.4(a)(2)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63). [10 CFR 54.4(a)(3)]

Process Facilities

The radwaste building is identified as a process facility and is included in this evaluation.

Radioactive Waste Building

The purpose of the radioactive waste, or radwaste, building is to house the liquid and solid waste processing equipment, offsite power cables affecting CTG 11-1 feed to standby feedwater, and RHR instrumentation equipment and cable. The alternative/dedicated shutdown system panels are located on the second floor of this building. The alternative shutdown system provides a dedicated shutdown panel from which an operator can monitor the reactor and keep the reactor core covered with water.

The radwaste building is structurally part of the turbine building and is bounded on the north by an outside wall, on the south and west by the turbine building and office and service building, and on the east by the onsite storage building. The walls, floor, and ceiling are constructed of reinforced concrete and concrete block. Door openings to the turbine building are equipped with Class A, B, and C fire doors. Penetrations through walls of the turbine building and office service building are sealed to provide a 3-hour barrier. Cable trays passing through floors are fire stopped.

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

The radwaste building has the following intended function for 10 CFR 54.4(a)(3).

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63) and for fire protection (10 CFR 50.48).

<u>*Yard Structures*</u>

Combustion Turbine Generator No. 11-1 (CTG 11-1) Structure

The purpose of CTG 11-1 is to provide AC electric power for distribution to the DTE Electric Company grid to meet peak power demands. CTG 11-1 generates AC electric power as an alternate power source for Fermi 2 to cope with a station blackout and to operate alternate safe shutdown equipment. CTG 11-1 provides emergency power if a fire occurs in the fire areas of concern or on a loss of offsite power should the emergency diesel generators be unavailable. Located near the 120kV switchyard, CTG 11-1 is one of four oil-fired General Electric "Frame 5" turbine generator units, numbered 11-1 through 11-4. The remaining CTG 11 units perform no license renewal intended function. CTG 11-1 has a diesel engine for black start capability. The remaining CTG 11 units are started with AC electric motors.

The CTGs are completely self-contained steel units anchored on separate and independent reinforced concrete slabs. The CTG 11-1 structure includes a fuel oil storage and supply system, equipment cooling water system, and batteries for black start.

The CTG 11-1 structure has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The CTG 11-1 structure has the following intended function for 10 CFR 54.4(a)(3).

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63).

Condensate Storage and Return Tanks Foundations and Retaining Barrier

The purpose of the condensate storage tank and the condensate return tank (CST/CRT) foundations and retaining barrier is to provide support for the condensate storage tank and condensate return tank. These tanks are used as the supply of water for standby feedwater, HPCI, control rod drive, RCIC, and core spray systems. The concrete dike provides for containment of any condensate loss that might be experienced in the immediate area around the tanks and for area fire protection. The CST/CRT foundations and retaining barrier are located east of the services building and south of the auxiliary boiler house.

Each tank foundation consists of a circular reinforced concrete foundation supported on consolidated structural backfill. All valves associated with the condensate storage or return tank are located in separate reinforced concrete valve pits at the base of each tank that are integral to their foundation. The tanks and foundations are located inside a lined dike area which is designed to collect the contents in event of a tank spill/overflow. The dike around the tanks is a three-foot-high reinforced concrete wall. The wall also prevents an exposure fire, or the heat from an exposure fire, in the yard area adjacent to the tanks from affecting the tanks themselves.

The CST/CRT foundations and retaining barrier have no intended functions for 10 CFR 54.4(a)(1) or (a)(3).

The CST/CRT foundations and retaining barrier have the following intended functions for 10 CFR 54.4(a)(2).

- Provide physical support, shelter, and protection for safety-related systems, structures, and components within the scope of license renewal.
- Provide physical support, shelter, and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1).

CTG-11 Fuel Oil Storage Tank Foundation

The purpose of the CTG-11 fuel oil storage tank (FOST) foundation is to provide support for the 800,000-gallon FOST for the Fermi 1 combustion turbine units. The CTG-11 FOST foundation is a nonsafety-related structure located approximately 1/3 mile south from the plant and safety-related plant structures. The CTG-11 FOST foundation consists of a circular reinforced concrete foundation supported on consolidated structural backfill.

The CTG-11 FOST foundation has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The CTG-11 FOST foundation has the following intended function for 10 CFR 54.4(a)(3).

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63).

Independent Spent Fuel Storage Installation (ISFSI) Rail Transfer Pad

The ISFSI rail transfer pad is located east of the south end of the RHR complex. The ISFSI rail transfer pad is a reinforced concrete roadway that provides for transfer of dry fuel casks. However, the pad also provides missile protection for the Division I and Division II safety-related duct banks located below the roadway.

The ISFSI rail transfer pad has the following intended function for 10 CFR 54.4(a)(1).

- Provide physical support, shelter, and protection for safety-related systems, structures, and components within the scope of license renewal.

The ISFSI rail transfer pad has no intended functions for 10 CFR 54.4(a)(2) or (a)(3).

Manholes, Handholes and Duct Banks

The purpose of manholes, handholes and duct banks is to provide structural support, shelter and protection to systems, structures, and components housed within these structures that are relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulated events during normal plant operation and during and following postulated design basis accidents.

Manholes and handholes consist of reinforced concrete rectangular box structures buried underground with a reinforced concrete panel on top. The manholes have an opening and a cover to allow access. There are safety-related and nonsafety-related manholes located in the yard area. The safety-related manholes are provided with a steel plate over the standard manhole cover or a thick concrete cover for missile protection.

Immediately adjacent to each manhole is a handhole structure, which is physically independent of the manhole structure but becomes part of the underground duct where it ties in on both sides of the manhole structure.

Duct banks comprise multiple raceways that are encased in concrete in an excavated trench, which is then backfilled with soil or engineered compacted backfill. The duct banks are used to route cables between structures and switchyard areas. Safety-related duct banks that are buried shallow in the yard are provided with a reinforced concrete protection slab that is cast over the duct bank for missile protection.

Manholes, handholes and duct banks allow underground routing of cables and some piping. The redundant trains of Class 1E electrical cable are routed through Category I manholes and handholes which are either entirely separate or designed with separating, reinforced concrete walls between the trains.

Manholes, handholes and duct banks have the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide physical support, shelter, and protection for safety-related systems, structures, and components. [10 CFR 54.4(a)(1)]
- Provide physical support, shelter, and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1). [10 CFR 54.4(a)(2)]
- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commissions' regulations for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63). [10 CFR 54.4(a)(3)]

Relay House, 120kV Switchyard

The relay house located in the 120kV switchyard is a nonsafety-related structure separated from safety-related systems, structures, and components such that its failure would not impact a safety function.

The structure is a prefabricated metal building and is founded on a reinforced concrete foundation. The purpose of the relay house is to provide housing for switchyard components and dc power components for circuit breaker control. There is one battery and charger in the 120kV switchyard relay house in support of station blackout.

The relay house, 120kV switchyard has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The relay house, 120kV switchyard has the following intended function for 10 CFR 54.4(a)(3).

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for station blackout (10 CFR 50.63).

Relay House, 345kV Switchyard

The relay house located in the 345kV switchyard is a nonsafety-related structure separated from safety-related systems, structures, and components such that its failure would not impact a safety function.

The structure consists of unreinforced concrete block walls with a composite roof construction and is founded on a reinforced concrete foundation. The purpose of the relay house is to provide housing for switchyard components and dc power components for circuit breaker control. There are two batteries and chargers in the 345kV switchyard relay house in support of station blackout.

The relay house, 345kV switchyard has no intended functions for 10 CFR 54.4(a)(1) or (a)(2)

The relay house, 345kV switchyard has the following intended function for 10 CFR 54.4(a)(3).

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for station blackout (10 CFR 50.63).

Transformer and Switchyard Support Structures and Foundations

The purpose of transformer and switchyard support structures and foundations is to provide structural support to systems, structures, and components that are relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for station blackout, specifically those necessary to recover offsite power following a station blackout.

The structures that provide physical support to the 120kV and 345kV switchyard components in the station blackout offsite power recovery path include the transformer foundations and foundations for the associated switchyard breakers, switchyard bus, switchyard towers, cable duct banks, and cable trenches. 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 transformer and switchyard support structures include the transformer and breaker foundations and supporting steel.

The transformer and switchyard support structures and foundations have no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The transformer and switchyard support structures and foundations have the following intended function for 10 CFR 54.4(a)(3).

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for station blackout (10 CFR 50.63).

UFSAR References

Turbine Building

Section 9A.4.5	Figure 1.2-7	Figure 1.2-10
	Figure 1.2-9	Figure 1.2-11

Radwaste Building

Section 9A.4.4	Figure 1.2-7
	Figure 1.2-12

CTG 11-1 Structure

Section 7.5.2.5.2

Section 8.2.1.2

CST/CRT Foundations and Retaining Barrier

Section 9A.4.7.2.1

Section 9.2.6.1

Section 9.2.6.2

CTG FOST

Section 2.2.3.4

ISFSI Rail Transfer Pad

Section 8.3.1.1.8.1

Section 9A.4.7.7.1

Manholes, Handholes and Duct Banks

Section 3.4.4.3

Section 8.3.1.1.8.1

Section 9A.4.7.7

Section 9A.4.7.10

Relay Houses

None

Transformer and Switchyard Support Structures and Foundations

Section 8.2 discusses system function.

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 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 in Section 2.4.4, Bulk Commodities.

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.

Table 2.4-3
Turbine Building, Process Facilities and Yard Structures
Components Subject to Aging Management Review

Component	Intended Function[a]
Steel and Other Metals	
Cranes: rails	Support for Criterion (a)(2) equipment
Cranes: structural girders	Support for Criterion (a)(2) equipment
Metal siding	Enclosure, protection Support for Criterion (a)(2) equipment
Monorails	Support for Criterion (a)(2) equipment
Pressure relief or blowout doors	Pressure relief
Roof decking or floor decking	Enclosure, protection Fire barrier Pressure relief
Steel missile barrier	Missile barrier
Structural steel: beams, columns, plates	Enclosure, protection Missile barrier Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Sump liners	Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Transmission tower, angle tower, pull-off tower	Support for Criterion (a)(3) equipment
Concrete	
Beams, columns and floor slabs	Enclosure, protection Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Concrete (accessible areas): interior and above-grade exterior	Enclosure, protection Flood barrier Missile barrier Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

**Table 2.4-3 (Continued)
Turbine Building, Process Facilities and Yard Structures
Components Subject to Aging Management Review**

Component	Intended Function[a]
Concrete (accessible areas): exterior above- and below-grade; foundation	Enclosure, protection Flood barrier Missile barrier Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Concrete (inaccessible areas): below-grade exterior; foundation	Enclosure, protection Flood barrier Missile barrier Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Cable tunnel	Support for Criterion (a)(3) equipment
CST/CRT retaining barrier	Enclosure, protection Fire barrier Support for Criterion (a)(2) equipment
Duct banks	Enclosure, protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Foundations (e.g., switchyard, transformers, tanks, circuit breakers, CTG, CTG-FOST)	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
ISFSI rail transfer pad	Missile barrier Support for Criterion (a)(1) equipment
Manholes and handholes	Enclosure, protection Fire barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Masonry walls	Enclosure, protection Fire barrier Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

Table 2.4-3 (Continued)
Turbine Building, Process Facilities and Yard Structures
Components Subject to Aging Management Review

Component	Intended Function[a]
Pipe tunnel	Enclosure, protection Missile barrier Support for Criterion (a)(3) equipment
Roof slabs	Enclosure, protection Missile barrier Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

a. Intended functions are defined in Table 2.0-1.

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, 2.4.2, and 2.4.3). Bulk commodities common to in-scope SSCs (e.g., concrete embedments and anchors, bolted connections/bolting, component supports, cable trays, compressible joints and seals, conduit, decking, doors (including air locks and bulkhead doors), electrical panels and enclosures, hatches/plugs, instrument panels and racks, miscellaneous steel, racks, piping and equipment supports, tube track supports) are addressed in this review.

Bulk commodities evaluated in this section are designed to support both safety-related and nonsafety-related equipment during normal and accident conditions in the event of external events (tornadoes, earthquakes, floods, missiles) and internal events (LOCA, pipe breaks).

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. [10 CFR 54.4(a)(1)]
- Maintain integrity of nonsafety-related structural components such that safety functions are not affected. [10 CFR 54.4(a)(2)]
- Provide support and protection for equipment credited in the Appendix R safe shutdown analysis and for fire protection (10 CFR 50.48), for environmental qualification (10 CFR 50.49), for anticipated transients without scram (10 CFR 50.62), and for station blackout (10 CFR 50.63). [10 CFR 54.4(a)(3)]

Insulation may have the specific intended functions of (1) maintaining local area temperatures within design limits or (2) maintaining integrity such that falling insulation does not damage safety-related equipment.

UFSAR 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.), as well as seismic II/I supports, are included in this evaluation. Insulation is subject to aging management review if it performs an intended function as described above.

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 2.4-4
Bulk Commodities
Components Subject to Aging Management Review

Component	**Intended Function[a]**
Steel and Other Metals	
Anchorage/ embedments	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) 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
Conduit	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Constant and variable load spring hangers; guides; stops (supports for ASME Class 1, 2 and 3 piping and components)	Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Doors	Enclosure, protection Flood barrier Missile protection Pressure boundary
Fire doors	Fire barrier Support for Criterion (a)(3) equipment
Fire hose reels	Support for Criterion (a)(3) equipment
Fire protection components—miscellaneous steel, including framing steel	Fire barrier
Manways, hatches, manhole covers and hatch covers	Enclosure, protection Flood barrier Pressure boundary Missile barrier 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

Table 2.4-4 (Continued)
Bulk Commodities
Components Subject to Aging Management Review

Component	Intended Function[a]
Missile shields	Enclosure, protection Missile barrier
Miscellaneous steel (decking, framing, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc.)	Enclosure, protection Flood barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Penetration seals (end caps)	Enclosure, protection Fire barrier Flood barrier Pressure boundary Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Penetration sleeves (mechanical/ electrical not penetrating primary containment boundary)	Enclosure, protection Fire barrier Flood barrier Pressure boundary Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Racks, panels, cabinets and enclosures for electrical equipment and instrumentation	Enclosure, protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Tube track	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Support members; welds; bolted connections; support anchorage to building structure	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

**Table 2.4-4 (Continued)
Bulk Commodities
Components Subject to Aging Management Review**

Component	Intended Function[a]
High strength structural bolting (supports for ASME Class 1, 2, 3 and MC piping and components)	Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Structural bolting; structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.)	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	
Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Equipment pads/foundations	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Curbs	Flood barrier Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Manways, hatches/plugs, 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
Structural fire barriers; walls, ceilings, floor slabs, curbs, dikes	Fire barrier

Table 2.4-4 (Continued)
Bulk Commodities
Components Subject to Aging Management Review

Component	Intended Function[a]
Support pedestals	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Other Materials	
Compressible joints and seals	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Fire stops	Fire barrier
Fire wrap	Fire barrier
Insulation (includes jacketing, wire mesh, tie wires, straps, clips)	Insulation Support for Criterion (a)(2) equipment
Penetration seals	Enclosure, protection Fire barrier Flood barrier Pressure boundary Support for Criterion (a)(2) equipment
Roof membranes	Enclosure, 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/expansion joint	Support for Criterion (a)(1) equipment
Vibration isolators	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment

a. 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 instrumentation and control (I&C) systems are included in the scope of license renewal as are electrical and I&C components in mechanical systems. The default inclusion of plant electrical and I&C systems in the scope of license renewal is the bounding approach used for the scoping of electrical systems.

The basic philosophy used in the electrical and I&C 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 electrical and I&C IPA began by grouping the total population of components into commodity groups. The commodity groups include similar electrical and I&C components with common characteristics. Component level intended functions of the commodity groups were identified. During the IPA screening process, commodity groups and specific plant systems were eliminated from further review if they did not perform or support an intended function.

In addition to the plant electrical systems, certain switchyard components used to restore offsite power following a station blackout (SBO) 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 April 1, 2002, SBO guidance letter[1] and NUREG-1800 Section 2.5.2.1.1 provide scoping guidance to include equipment needed for off-site power recovery, which includes equipment not explicitly required for compliance with 10 CFR 50.63.

LRA Drawing LRA-E-001 depicts the electrical interconnection between Fermi 2 and the offsite transmission network. LRA Drawing LRA-E-001 identifies major components or commodities associated with off-site power recovery following SBO. The highlighted portions depict the components that are subject to aging management review. Portions not highlighted in the off-site power circuits have no intended function for license renewal and thus are not subject to aging management review.

1. NRC to NEI, "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the Station Blackout (SBO) Rule (10 CFR 50.63) for License Renewal (10 CFR 54.4(a)(3))," letter dated April 1, 2002 (ISG-02). Agencywide Documents Access and Management System [ADAMS] accession number ML020920464.

UFSAR References

Additional details for electrical systems and commodities can be found in UFSAR Chapters 7 and 8.

Scoping Boundaries

Plant electrical and I&C systems are included in the scope of license renewal as are electrical and I&C components in mechanical systems.

The Fermi 2 345-kV off-site power system is a source of physically independent preferred off-site power sources. Auxiliary transformer SS 65 serving Division II ESF buses is fed from the east bus (bus 301) of the 345-kV switchyard. The first isolation devices upstream of SS 65 are circuit breakers BM, CF and DF. These circuit breakers are the scoping boundary for this qualified source of offsite power utilized during restoration of offsite power following an SBO. Components in the 345-kV off-site power path consist of switchyard bus and connections, high-voltage insulators, transmission conductors and connections, control circuit cables and connections, and medium-voltage cables and connections.

The Fermi 2 120-kV off-site power system is a source of physically independent preferred off-site power sources. Auxiliary transformer SS 64 serving Division I ESF buses is fed from 13.2-kV bus 11 in the 120-kV switchyard. The first isolation device upstream of bus 11 is circuit breaker A. This circuit breaker is the scoping boundary for this qualified source of offsite power utilized during restoration of offsite power following a SBO. Components in the 120-kV off-site power path consist of switchyard bus and connections, high-voltage insulators, control circuit cables and connections, and medium-voltage cables and connections.

Steel transmission towers and foundations, structures housing switchyard batteries, and structures supporting breakers, disconnects, transformers, transmission conductors, and switchyard bus utilized in the 120-kV and the 345-kV off-site power recovery paths are evaluated in Section 2.4, Scoping and Screening Results: Structures.

Commodity Groups Subject to AMR

As discussed in Section 2.1.2.3.1, Fermi 2 passive electrical commodity groups correspond to two of the passive commodity groups identified in NEI 95-10:

- High voltage insulators.
- Cables and connections, bus, electrical portions of electrical and I&C penetration assemblies, fuse holders outside of cabinets of active electrical components.

The commodity group cables, connections, bus, electrical portions of electrical and I&C penetration assemblies, and fuse holders outside of cabinets of active electrical components is further subdivided into the following.

- Cable connections (metallic parts).
- Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements.
- 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 used in instrumentation circuits.
- Electrical and I&C penetration cables and connections not subject to 10 CFR 50.49 EQ requirements.[2]
- Fuse holders – insulation material.
- Fuse holders – metallic clamp.
- Inaccessible power (400 V to 13.8 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 – bus / connections.
- Metal enclosed bus – enclosures assemblies (elastomers, external surfaces).
- Metal enclosed bus – insulation / insulators.
- Switchyard bus and connections.
- Transmission conductors and connections.
- Uninsulated ground conductors.[3]

<u>Commodity Groups Not Subject to AMR</u>

<u>Electrical and I&C Penetration Assemblies</u>

All Fermi 2 electrical and I&C penetration assemblies are in the EQ program (10 CFR 50.49). Fermi 2 electrical and I&C penetration assemblies in the EQ program are subject to replacement based on their qualified life, so they are not subject to aging management review. Non-EQ cables and connections to electrical and I&C penetrations are evaluated in the insulated cable and connection commodity group.

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1. Fermi 2 electrical cables and connections subject to 10 CFR 50.49 EQ requirements are not subject to aging management review (STAMR) since the components are subject to replacement based on qualified life.
2. All Fermi 2 electrical and I&C penetration assemblies are in the EQ Program (10 CFR 50.49). Fermi 2 EIC penetration assemblies in the EQ Program are not STAMR since the components are subject to replacement based on qualified life.
3. Fermi 2 uninsulated ground conductors are not STAMR because they do not perform a license renewal intended function. The purpose of uninsulated ground conductors is to limit equipment damage in the event of a circuit failure.

Uninsulated Ground Conductors

A review of the Fermi 2 UFSAR did not identify a license renewal intended function for uninsulated ground conductors. These components are not safety-related and are not credited for mitigation of regulated events. Industry and plant-specific operating experience for uninsulated ground conductors does not indicate credible failure modes that would adversely affect an intended function; therefore, credible uninsulated ground conductor failures that could prevent satisfactory accomplishment of safety functions are hypothetical. As discussed in Section 2.1.3.1.2 of NUREG-1800 and Section III.c(iii) of the statements of consideration (SOC) (60 FR 22467), hypothetical failures that are not part of the current licensing basis and have not been previously experienced 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 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
Conductor insulation for inaccessible power (400 V to 13.8 kV) cables (e.g., installed underground in conduit, duct bank or direct buried) not subject to 10 CFR 50.49 EQ requirements	Insulation (electrical)
Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) not subject to 10 CFR 50.49 EQ requirements	Insulation (electrical)
Insulation material for electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits	Insulation (electrical)
Insulation material for EIC penetration cables and connections not subject to 10 CFR 50.49 EQ requirements	Insulation (electrical)
Fuse holders (not part of active equipment): insulation material	Insulation (electrical)
Fuse holders (not part of active equipment): metallic clamps	Conducts electricity
High voltage insulators (for SBO recovery)	Insulation (electrical)
Metal enclosed bus: bus/connections	Conducts electricity
Metal enclosed bus: enclosure assemblies (elastomers, external surfaces)	Conducts electricity
Metal enclosed bus: insulation, insulators	Insulation (electrical)
Switchyard bus and connections (for SBO recovery)	Conducts electricity
Transmission conductors and connections (for SBO recovery)	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-1800 (Ref. 3.0-1).

  1 indicates that this is the first table type in Section 3.x.

For example, in the reactor coolant system section, this is Table 3.1.1, and in the engineered safety features section, 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-1800 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-1800.

  2 indicates that this is the second table type in Section 3.x.

  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 nuclear pressure relief system results are presented in Table 3.2.2-1, and the residual heat removal 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 Fermi 2 AMR results align with the corresponding table of NUREG-1800. These tables are essentially the same as Tables 3.1-1 through 3.6-1 provided in NUREG-1800 as amended by applicable Interim Staff Guidance documents, with the following exceptions.

- The “ID” (identification) 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 "Rev 2 Item" and “Rev 1 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-1800.

- Component
- Aging Effect/Mechanism
- Aging Management Programs
- Further Evaluation Recommended

Further information is provided in the "Discussion" column. The Discussion column explains, in summary, how the Fermi 2 evaluations align with NUREG-1800 and NUREG-1801 (Ref. 3.0-2). 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-1800 and NUREG-1801 assumptions.
- A discussion of how the line item is consistent with the corresponding line item in NUREG-1800, when it may not be intuitively obvious.
- A discussion of how the line item is different from the corresponding line item in NUREG-1800, 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 system group. For example, the engineered safety features system group contains tables specific to nuclear pressure relief, residual heat removal, core spray, high pressure coolant injection, reactor core isolation cooling, containment penetrations, and standby gas treatment systems.

Table 2s also provide a comparison of the AMR results with the AMR results in NUREG-1801. Comparison to NUREG-1801 is performed by considering the component type, material, environment, aging effect requiring management (AERM), 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, flued heads, reducers, tees, etc.).

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 Item

Each combination of the following factors listed in Table 2 is compared to NUREG-1801 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 item number. If there is no corresponding item number in NUREG-1801 for a particular combination of factors, column 7 is left blank.

Comparisons of system and structure aging management results to NUREG-1801 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 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, 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-1800, then column 8 is left blank.

Each combination of the following that has an identified NUREG-1801 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. Notes that use letter designations are standard notes based on Table 4.2-2 of NEI 95-10 (Ref. 3.0-3). Notes that use numeric designators are specific to the plant site.

Some 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.

FURTHER EVALUATION REQUIRED

The Table 1s in NUREG-1800 indicate that further evaluation is necessary for certain aging effects and other issues discussed in NUREG-1800. 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 2, U. S. Nuclear Regulatory Commission, December 2010.

3.0-2 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 2, U. S. Nuclear Regulatory Commission, December 2010.

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	Corresponding NUREG-1801 Environments
Air – indoor	Air in an environment protected from precipitation.	Air – indoor uncontrolled Air – indoor uncontrolled > 35°C (> 95°F) Air with reactor coolant leakage Air with steam or water leakage System temperature up to 288°C (550°F)
Air – outdoor	The outdoor environment consists of atmospheric air, ambient temperature and humidity, and exposure to precipitation.	Air – outdoor
Concrete	Components in contact with concrete.	Concrete
Condensation	Air and condensation on surfaces of indoor systems with temperatures below dew point; condensation is considered untreated water due to potential for surface contamination. For compressed air systems with dryers, condensation may be conservatively identified as the internal environment.	Condensation
Exhaust gas	Gases, fluids, particulates present in diesel engine exhaust.	Diesel exhaust
Fuel oil	Diesel oil, No. 2 oil, or other liquid hydrocarbons used to fuel diesel engines, boilers, etc.	Fuel oil
Gas	Internal dry non-corrosive gas environments such as nitrogen, carbon dioxide, Freon, and Halon.	Gas
Lube oil	Lubricating oils are low to medium viscosity hydrocarbons used for bearing, gear, and engine lubrication. An oil analysis program may be credited to preclude water contamination.	Lubricating oil

Table 3.0-1 (Continued)
Service Environments for Mechanical Aging Management Reviews

Environment	Description	Corresponding NUREG-1801 Environments
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.	Neutron flux High fluence (> 1 x 10^{21} n/cm^2, E > 0.1 million electron volts [MeV])
Raw water	Consists of untreated surface or ground water, whether fresh, brackish, or saline in nature, or water not treated by a chemistry program such as water supplied from an off-site source for fire protection.	Raw water
Soil	External environment for components buried in the soil; exposure to ground water is assumed in soil environments	Soil
Steam	Steam, subject to a water chemistry program. In determining aging effects, steam is considered treated water.	Steam Reactor coolant
Treated water	Treated water is demineralized water and is the base water for all clean systems.[1]	Treated water Closed-cycle cooling water Raw water (potable) Reactor coolant
Treated water > 140°F	Treated water above the stress corrosion cracking (SCC) threshold for stainless steel	Treated water > 60°C (> 140°F) Closed-cycle cooling water > 60°C (> 140°F) Reactor coolant > 60°C (> 140°F)
Treated water > 482°F	Treated or demineralized water above thermal embrittlement threshold for cast austenitic stainless steel (CASS).	Treated water > 250°C (> 482°F) Reactor coolant > 250°C (> 482°F)

Table 3.0-1 (Continued)
Service Environments for Mechanical Aging Management Reviews

Environment	Description	Corresponding NUREG-1801 Environments
Waste water	Water in liquid waste drains such as in liquid radioactive waste systems, oily waste systems, floor drainage systems, chemical waste water systems, and secondary waste water systems. Waste waters may contain contaminants, including oil and boric acid, as well as treated water not monitored by a chemistry program.	Waste water

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, raw (potable) water, 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 Treated Water Systems 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	Corresponding NUREG-1801 Environments
Air – indoor uncontrolled	Air with temperature less than 150°F, humidity up to 100 percent and protected from precipitation. The air-indoor uncontrolled (external) environment is for indoor locations that are sheltered or protected from weather. Humidity levels up to 100 percent are assumed and the surfaces of components in this environment may be wet. This environment may contain aggressive chemical species including oxygen, halides, sulfates, or other aggressive corrosive substances that can influence the nature, rate, and severity of corrosion effects. It is assumed that these contaminants can concentrate to levels that will promote corrosive effects because of factors such as cyclic (wet-dry) condensation, contaminated insulation, accidental contamination, or leakage areas.	Air – indoor uncontrolled
Air – outdoor	Exposed to the weather with air temperature less than 115°F, humidity up to 100 percent. This environment is subject to periodic wetting and wind. This environment may contain aggressive chemical species including chlorides, oxygen, halides, sulfates, or other aggressive corrosive substances that can influence the nature, rate, and severity of corrosion effects.	Air – outdoor
Concrete	This environment consists of components embedded in concrete.	Concrete

Table 3.0-2 (Continued)
Service Environments for Structural Aging Management Reviews

Environment	Description	Corresponding NUREG-1801 Environments
Exposed to fluid environment	Fluid environment for structures at Fermi 2 is defined as raw water or treated water. • Raw water – Water from Lake Erie provides the source of raw water utilized at Fermi 2. 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. Fermi 2 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.	Ground water Treated water Treated water > 140°F Water – flowing Water – standing
Soil	External environment for components at the air/soil interface, buried in the soil, or exposed to groundwater in the soil. This environment can be "aggressive or "non-aggressive" depending on its soil properties as defined in NUREG-1801.	Soil

Table 3.0-3
Service Environments for Electrical Aging Management Reviews

Environment	Description	Corresponding NUREG-1801 Environments
Air – indoor controlled	This environment is one to which the specified internal or external surface of the component or structure is exposed; a humidity-controlled (i.e., air conditioned) environment. For electrical purposes, control must be sufficient to eliminate the cited aging effects of contamination and oxidation without affecting the resistance.	Air – indoor controlled
Air – indoor uncontrolled	Uncontrolled indoor air is associated with systems with temperatures higher than the dew point (i.e., condensation can occur, but only rarely; equipment surfaces are normally dry).	Air – indoor uncontrolled
Air – outdoor	The outdoor environment consists of moist, possibly salt-laden atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation and wind. The component is exposed to air and local weather conditions, including salt water spray (if present). A component is considered susceptible to a wetted environment when it is submerged, has the potential to collect water, or is subject to external condensation.	Air – outdoor
Heat, moisture, or radiation and air	Condition in a limited plant area that is significantly more severe than the plant design environment for the cable or connection insulation materials caused by heat, radiation, or moisture, and air.	Adverse localized environment caused by heat, radiation or moisture
Significant moisture	Condition in a limited plant area that is significantly more severe than the plant design environment for the cable or connection insulation materials caused by significant moisture (moisture that lasts more than a few days—e.g., cable in standing water)	Adverse localized environment caused by significant moisture

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 (RCS) 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 2.3.1.1.1)
- Reactor Vessel Internals (Section 2.3.1.1.2)
- Reactor Coolant Pressure Boundary (Section 2.3.1.2)
- Miscellaneous RCS systems in Scope for 10 CFR 54.4(a)(2) (Section 2.3.1.7)

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 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

Miscellaneous RCS Systems in Scope for 10 CFR 54.4(a)(2)

- Table 3.1.2-4-1 Nuclear Boiler System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.1.2-4-2 Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.1.2-4-3 Neutron Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

3.1.2.1 Materials, Environments, Aging Effects Requiring Management, and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the reactor vessel, internals and reactor coolant system components. Programs are described in Appendix B. Further details are provided in Tables 3.1.2-1 through 3.1.2-4-3.

3.1.2.1.1 Reactor Vessel

Materials

Reactor vessel components are constructed of the following materials.

- Carbon steel
- Carbon steel clad with stainless steel
- Cast austenitic stainless steel (CASS)
- High-strength low-alloy steel
- Nickel alloy
- Stainless steel

Environments

Reactor vessel 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 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
- Flow-Accelerated Corrosion
- Inservice Inspection
- One-Time Inspection
- 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.

- CASS
- CASS with stellite hard facing
- Nickel alloy
- Stainless steel

Environments

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 material – wear
- 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
- One-Time Inspection
- 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
- Copper alloy >15% zinc or > 8% aluminum
- High-strength steel
- Stainless steel

Environments

Reactor coolant pressure boundary components are exposed to the following environments.

- Air – indoor
- Lube oil
- 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
- Oil Analysis
- One-Time Inspection
- One-Time Inspection – Small-Bore Piping
- Selective Leaching
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.1.2.1.4 Miscellaneous RCS 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 3.1.2-4-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
- Stainless steel

Environments

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- Air – indoor
- Condensation
- Lube oil
- Steam
- Treated water
- Treated water > 140°F
- Waste water

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 aging effects for nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- Compressed Air Monitoring
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.1.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.1.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the Fermi 2 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, 4.3.1.2, and 4.3.1.3.

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 4.3.1.4. Cracking, including cracking due to fatigue, will be managed by the BWR Vessel Internals Program for other internals components.

The evaluation of fatigue TLAA for the ASME Class 1 portions of the reactor coolant pressure boundary piping and components, including those for interconnecting systems, is discussed in Sections 4.3.1.5 and 4.3.1.6.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

1. This paragraph in NUREG-1800 pertains to pressurized water reactor (PWR) steam generators and is therefore not applicable to Fermi 2.
2. This paragraph in NUREG-1800 pertains to PWR steam generator shell assemblies and is therefore not applicable to Fermi 2.

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. Fermi 2 is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP). This program manages 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. This paragraph in NUREG-1800 pertains to a plant-specific TLAA for Babcock and Wilcox reactor internals and is therefore not applicable to Fermi 2.

3.1.2.2.4 Cracking due to Stress Corrosion Cracking (SCC) and Intergranular Stress Corrosion Cracking (IGSCC)

1. Cracking due to SCC and IGSCC of the stainless steel reactor vessel closure head flange leak detection line will be managed by the Water Chemistry Control – BWR and One-Time Inspection Programs. The stainless steel portion of the vessel flange leak detection line is a short instrumentation branch line supplying a nonsafety-related pressure switch. The main leak detection line flow path to drain is carbon steel. The Water Chemistry Control – BWR Program minimizes contaminants which promote SCC. The One-Time Inspection Program will use visual or other nondestructive examination (NDE) techniques to verify the absence of significant cracking of the line.

2. This paragraph in NUREG-1800 pertains to BWR isolation condenser components. Fermi 2 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 Cracking due to Stress Corrosion Cracking

Both paragraphs in NUREG-1800 apply to PWRs only.

3.1.2.2.7 Cracking due to Cyclic Loading

This paragraph in NUREG-1800 pertains to BWR isolation condenser components. As Fermi 2 does not have an isolation condenser, this paragraph was not used.

3.1.2.2.8 Loss of Material due to Erosion

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.9 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.10 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.11 Cracking due to Primary Water Stress Corrosion Cracking (PWSCC)

Both paragraphs in NUREG-1800 apply to PWRs only.

3.1.2.2.12 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.13 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.14 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of Fermi 2 quality assurance procedures and administrative controls for aging management programs.

3.1.2.2.16 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of Fermi 2 operating experience review 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 vessel, internals, and 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					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-1	High strength, low-alloy steel top head closure stud assembly exposed to air with potential for reactor coolant leakage	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.
3.1.1-2	PWR only				
3.1.1-3	Stainless steel or nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-4	Steel pressure vessel support skirt and attachment welds	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.
3.1.1-5	PWR only				
3.1.1-6	Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor coolant pressure boundary components: piping, piping components, and piping elements exposed to reactor coolant	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-7	Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.
3.1.1-8	PWR only				
3.1.1-9	PWR only				
3.1.1-10	PWR only				
3.1.1-11	Steel or stainless steel pump and valve closure bolting exposed to high temperatures and thermal cycles	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.1.
3.1.1-12	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-13	Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds exposed to reactor coolant and neutron flux	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA is to be evaluated in accordance with Appendix G of 10 CFR Part 50 and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations	Yes, TLAA	Fatigue is a TLAA. See Section 3.1.2.2.3 Item 1.
3.1.1-14	Steel (with or without cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles	Loss of fracture toughness due to neutron irradiation embrittlement	Chapter XI.M31, "Reactor Vessel Surveillance"	Yes, plant specific or integrated surveillance program	Consistent with NUREG-1801. The Reactor Vessel Surveillance Program will manage loss of fracture toughness of the reactor vessel beltline materials including the instrument nozzles. See Section 3.1.2.2.3 Item 2.
3.1.1-15	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-16	Stainless steel and nickel alloy top head enclosure vessel flange leak detection line	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line.	Yes, plant-specific	The seal leak detection nozzle and main leak detection line are carbon steel. Cracking of the stainless steel instrument line off the main leak detection line is managed by the One-Time Inspection and Water Chemistry Control – BWR Programs. See Section 3.1.2.2.4 Item 1.
3.1.1-17	Stainless steel isolation condenser components exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry" for BWR water, and a plant-specific verification program	Yes, detection of aging effects is to be evaluated	This item was not used. Fermi 2 does not have an isolation condenser. See Section 3.1.2.2.4 Item 2.
3.1.1-18	PWR only				
3.1.1-19	PWR only				
3.1.1-20	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-21	Steel and stainless steel isolation condenser components exposed to reactor coolant	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components The ISI program is to be augmented by a plant-specific verification program	Yes, detection of aging effects is to be evaluated	This item was not used. Fermi 2 does not have an isolation condenser. See Section 3.1.2.2.7.
3.1.1-22	PWR only				
3.1.1-23	[There is no 3.1.1-23 in NUREG-1800 as modified by the ISGs.]				
3.1.1-24	[There is no 3.1.1-24 in NUREG-1800 as modified by the ISGs.]				
3.1.1-25	PWR only				
3.1.1-26	[There is no 3.1.1-26 in NUREG-1800 as modified by the ISGs.]				
3.1.1-27	[There is no 3.1.1-27 in NUREG-1800 as modified by the ISGs.]				
3.1.1-28	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-29	Nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry," and for BWRs with a crevice in the access hole covers, augmented inspection using UT or other acceptable techniques	No	Consistent with NUREG-1801. Cracking of nickel alloy elements of the shroud support access hole covers is managed by the Inservice Inspection and Water Chemistry Control – BWR Programs. The shroud support access hole covers do not contain creviced welds.
3.1.1-30	Stainless steel or nickel alloy penetration: drain line exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry"	No	This item was not used. The Fermi 2 vessel does not have a stainless steel or nickel alloy drain penetration.
3.1.1-31	Steel and stainless steel isolation condenser components exposed to reactor coolant	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry"	No	This item was not used. Fermi 2 does not have an isolation condenser.
3.1.1-32	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
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				
3.1.1-38	Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250 deg-C (>482 deg-F)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components. For pump casings and valve bodies, screening for susceptibility to thermal aging is not necessary.	No	Consistent with NUREG-1801. The Inservice Inspection Program manages the reduction of fracture toughness in cast austenitic stainless steel pump casings and valve bodies in the reactor coolant pressure boundary.

Table 3.1.1: *Reactor Coolant System*

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-39	Steel, stainless steel, or steel with stainless steel cladding Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal, mechanical, and vibratory loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, Chapter XI.M2, "Water Chemistry," and XI.M35, "One-Time Inspection of ASME Code Class 1 Small-bore Piping"	No	Consistent with NUREG-1801. Cracking in steel and stainless steel components of the reactor coolant pressure boundary exposed to reactor coolant is managed by the Inservice Inspection 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 fittings < 4" NPS.
3.1.1-40	PWR only				
3.1.1-40.5	PWR only				
3.1.1-41	Nickel alloy core shroud and core plate access hole cover (mechanical covers) exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"	No	This item was not used. The shroud support access hole covers are welded.
3.1.1-42	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-43	Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"	No	Loss of material for stainless steel and nickel alloy reactor vessel internals components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry program. With minor exceptions, the reactor vessel internals are not ASME Class 1 pressure boundary components, and the scope of internals components inspected under the Inservice Inspection Program is limited.
3.1.1-44	PWR only				
3.1.1-45	PWR only				
3.1.1-46	PWR only				
3.1.1-47	PWR only				
3.1.1-48	PWR only				
3.1.1-49	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-50	Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant >250 deg-C (>482 deg-F)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No	This item was not used. The Inservice Inspection Program manages the reduction of fracture toughness in cast austenitic stainless steel pump casings and valve bodies in the reactor coolant pressure boundary (see Item 3.1.1-38). There are no other Class 1 CASS components in the reactor coolant system pressure boundary. The main steam line flow elements (flow restrictors) and recirculation loop flow elements are not Class 1 components (elements are completely internal to the carbon steel pipe). The CASS subcomponents of the flow elements are not susceptible to thermal aging embrittlement since they are composed of low-molybdenum CASS (CF8) and were centrifugally cast.
3.1.1-51a	PWR only				
3.1.1-51b	PWR only				
3.1.1-52a	PWR only				
3.1.1-52b	PWR only				
3.1.1-52c	PWR only				
3.1.1-53a	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-53b	PWR only				
3.1.1-53c	PWR only				
3.1.1-54	PWR only				
3.1.1-55a	PWR only				
3.1.1-55b	PWR only				
3.1.1-55c	PWR only				
3.1.1-56a	PWR only				
3.1.1-56b	PWR only				
3.1.1-56c	PWR only				
3.1.1-57	[There is no 3.1.1-57 in NUREG-1800.]				
3.1.1-58a	PWR only				
3.1.1-58b	PWR only				
3.1.1-59a	PWR only				
3.1.1-58b	PWR only				
3.1.1-58c	PWR only				
3.1.1-60	Steel piping, piping components, and piping elements exposed to reactor coolant	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801. The Flow-Accelerated Corrosion Program manages wall thinning due to flow-accelerated corrosion in steel piping components exposed to reactor coolant.

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-61	PWR only				
3.1.1-62	PWR only				
3.1.1-63	Steel or stainless steel closure bolting exposed to air with reactor coolant leakage	Loss of material due to general (steel only), pitting, and crevice corrosion or wear	Chapter XI.M18, "Bolting Integrity"	No	The Bolting Integrity Program, which applies to all pressure boundary bolting in the reactor coolant system with the exception of the reactor closure head studs, manages loss of material for steel bolting. 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.
3.1.1-64	PWR only				
3.1.1-65	PWR only				
3.1.1-66	PWR only				
3.1.1-67	Steel or stainless steel closure bolting exposed to air – indoor with potential for reactor coolant leakage	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. The Bolting Integrity Program manages loss of preload for all pressure boundary bolting in the reactor coolant system with the exception of the reactor closure head studs.
3.1.1-68	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
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				
3.1.1-78	PWR only				
3.1.1-79	Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material in stainless steel reactor coolant pressure boundary components 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. Nickel-alloy reactor vessel components supporting the reactor coolant pressure boundary are addressed in Item 3.1.1-85.
3.1.1-80	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-81	PWR only				
3.1.1-82	PWR only				
3.1.1-83	PWR only				
3.1.1-84	Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant	Loss of material due to general, pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material in steel reactor vessel components 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.
3.1.1-85	Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material in stainless steel, nickel-alloy, and steel with stainless steel cladding reactor vessel components 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.
3.1.1-86	PWR only				
3.1.1-87	[not used]				
3.1.1-88	PWR only				
3.1.1-89	PWR only				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-90	PWR only				
3.1.1-91	High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage	Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (BWR)	Chapter XI.M3, "Reactor Head Closure Stud Bolting"	No	Consistent with NUREG-1801. Cracking and loss of material in closure head stud assembly components is managed by the Reactor Head Closure Studs Program.
3.1.1-92	PWR only				
3.1.1-93	PWR only				
3.1.1-94	Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M4, "BWR Vessel ID Attachment Welds," and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801. The BWR Vessel ID Attachment Welds and Water Chemistry Control – BWR Programs manage cracking in stainless steel and nickel alloy vessel attachment welds exposed to reactor coolant.
3.1.1-95	Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant	Cracking due to cyclic loading	Chapter XI.M5, "BWR Feedwater Nozzle"	No	Consistent with NUREG-1801. The BWR Feedwater Nozzle Program manages cracking in the carbon steel feedwater nozzles exposed to reactor coolant.

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-96	Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant	Cracking due to cyclic loading	Chapter XI.M6, "BWR Control Rod Drive Return Line Nozzle"	No	This item was not used. The Fermi 2 control rod drive return line was cut and capped before initial plant operation. The nozzles have not been exposed to thermal cyclic loading from operation of the return line.
3.1.1-97	Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	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 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 or BWR CRD Return Line Nozzle Program.

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-98	Stainless steel or nickel alloy penetrations: instrumentation and standby liquid control exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	Chapter XI.M8, "BWR Penetrations," and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801. Cracking in stainless steel and nickel alloy nozzles and penetrations in the reactor vessel is managed by the BWR Penetrations and Water Chemistry Control – BWR Programs.
3.1.1-99	Cast austenitic stainless steel; PH martensitic stainless steel; martensitic stainless steel; X-750 alloy reactor internal components exposed to reactor coolant and neutron flux	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Chapter XI.M9, "BWR Vessel Internals"	No	Consistent with NUREG-1801 for CASS and X-750 (nickel alloy) components. The BWR Vessel Internals Program manages reduction of fracture toughness for CASS and X-750 components. Martensitic stainless steels are not used in the Fermi 2 vessel internals.
3.1.1-100	Stainless steel reactor vessel internals components (jet pump wedge surface) exposed to reactor coolant	Loss of material due to wear	Chapter XI.M9, "BWR Vessel Internals"	No	Consistent with NUREG-1801. The BWR Vessel Internals Program manages wear of the jet pump wedges.
3.1.1-101	Stainless steel steam dryers exposed to reactor coolant	Cracking due to flow-induced vibration	Chapter XI.M9, "BWR Vessel Internals" for steam dryer	No	Consistent with NUREG-1801. The BWR Vessel Internals Program manages cracking of the stainless steel steam dryer due to flow induced vibration.

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-102	Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801. The BWR Vessel Internals and Water Chemistry Control – BWR Programs manage cracking of the stainless steel fuel supports and control rod guide components.
3.1.1-103	Stainless steel and nickel alloy reactor internal components exposed to reactor coolant and neutron flux	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"	No	Consistent with NUREG-1801 for most components. The BWR Vessel Internals and Water Chemistry Control – BWR Programs manage cracking of most stainless steel and nickel alloy reactor internals components. Cracking of the incore instrument dry tubes is managed by the Inservice Inspection and Water Chemistry Control – BWR Programs.
3.1.1-104	X-750 alloy reactor vessel internal components exposed to reactor coolant and neutron flux	Cracking due to intergranular stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals" for core plate, and Chapter XI.M2, "Water Chemistry"	No	This item was not used. The Fermi 2 vessel internals do not have X-750 alloy core plate components.

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-105	Steel piping, piping components and piping element exposed to concrete	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	This item was not used. No steel reactor coolant pressure boundary piping components are embedded in concrete.
3.1.1-106	Nickel alloy piping, piping components and piping element exposed to air – indoor, uncontrolled, or air with borated water leakage	None	None	NA – No [aging effect/ mechanism] AEM or AMP	Consistent with NUREG-1801.
3.1.1-107	Stainless steel piping, piping components and piping element exposed to gas, concrete, air with borated water leakage, air – indoors, uncontrolled	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.
3.1.1-108	[There is no 3.1.1-108 in NUREG-1800.]				
3.1.1-109	[There is no 3.1.1-109 in NUREG-1800.]				

Table 3.1.1: Reactor Coolant System					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-110	Any material, piping, piping components, and piping elements exposed to reactor coolant	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	This line was not used. Based on plant operating experience, components of the Reactor Coolant System are not susceptible to erosion.

Notes for Tables 3.1.2-1 through 3.1.2-4-3

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 has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect and aging management program listed 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 listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

101. The One-Time Inspection Program will verify effectiveness of the Water Chemistry Control – BWR Program.

102. High component surface temperature precludes moisture accumulation that could result in corrosion.

103. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

104. Stress corrosion cracking of the steam dryer is not an identified aging mechanism in NUREG-1801.

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 Item	Table 1 Item	Notes
Reactor vessel components	Pressure boundary Structural support	Carbon steel, stainless steel, nickel alloy, carbon steel clad with stainless steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	IV.A1.R-04	3.1.1-7	A
Reactor vessel closure bolting • Closure head studs, nuts,, washers and bushings • Upper head nozzle flange bolting • CRD flange bolting • Incore housing bolting	Pressure boundary	High-strength low-alloy steel	Air – indoor (ext)	Cracking – fatigue	TLAA – metal fatigue	IV.A1.RP-201	3.1.1-1	A
Reactor vessel external attachments • Support skirt • Stabilizer brackets	Structural support	Carbon steel	Air – indoor (ext)	Cracking – fatigue	TLAA – metal fatigue	IV.A1.R-70	3.1.1-4	A

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Attachments and Supports and Welds								
Reactor vessel external attachments • Support skirt	Structural support	Carbon steel	Air – indoor (ext)	Loss of material	Inservice Inspection	--	--	H
Reactor vessel internal attachments • Steam dryer hold down lug	Structural support	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101
Reactor vessel internal attachments • Guide rod brackets • Steam dryer support lugs • Core spray brackets • Feedwater sparger brackets • Surveillance specimen brackets	Structural support	CASS	Treated water > 140°F (ext)	Cracking	BWR Vessel ID Attachment Welds Water Chemistry Control – BWR	IV.A1.R-64	3.1.1-94	A
			Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
			Treated water > 482°F (ext)	Reduction of fracture toughness	BWR Vessel Internals	IV.B1.RP-220	3.1.1-99	C
Reactor vessel internal attachments • Jet pump riser support pads and pad to riser brace welds	Structural support	Nickel alloy	Treated water (ext)	Cracking	BWR Vessel ID Attachment Welds Water Chemistry Control – BWR	IV.A1.R-64	3.1.1-94	A

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Reactor vessel internal attachments • Jet pump riser support pads and pad to riser brace welds	Structural support	Nickel alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Welds • Guide rod brackets to vessel • Steam dryer support lugs to vessel • Core spray brackets to vessel • Feedwater sparger brackets to vessel • Surveillance specimen brackets to vessel	Structural support	Nickel alloy	Treated water (ext)	Cracking	BWR Vessel ID Attachment Welds Water Chemistry Control – BWR	IV.A1.R-64	3.1.1-94	A
			Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Bolting								
In-core housing bolting • CRD flange bolting • Upper head nozzle flange bolting	Pressure boundary	High-strength low-alloy steel	Air – indoor (ext)	Cracking	Bolting Integrity	V.E.E-03	3.2.1-12	D

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
In-core housing bolting • CRD flange bolting • Upper head nozzle flange bolting	Pressure boundary	High-strength low-alloy steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	D
Reactor vessel closure flange bolting • Closure studs, nuts, washers and bushings	Pressure boundary	High-strength low-alloy steel	Air – indoor (ext)	Cracking	Reactor Head Closure Studs	IV.A1.RP-51	3.1.1-91	B
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	IV.A1.RP-165	3.1.1-91	B
Nozzles and Penetrations and Welds								
CRD housings	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
CRD housings	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-104	3.1.1-102	A
CRD housings	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Penetrations • In-core housings	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Penetrations • In-core housings	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	BWR Penetrations Water Chemistry Control – BWR	IV.A1.RP-369	3.1.1-98	A
Penetrations • In-core housings	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Penetrations • Core differential pressure/SLC nozzle • CRD stub tubes	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	IV.E.RP-03	3.1.1-106	A
Penetrations • Core differential pressure/SLC nozzle • CRD stub tubes	Pressure boundary	Nickel alloy	Treated water (int)	Cracking	BWR Penetrations Water Chemistry Control – BWR	IV.A1.RP-369	3.1.1-98	A
Penetrations • Core differential pressure/SLC nozzle • CRD stub tubes	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Nozzles • Recirc outlet (N1) • Recirc inlet (N2) • Steam (N3) • Core spray (N5) • Spare Instrumentation (N6) • Vent (N7) • Jet pump instrument (N8) • CRD hydraulic system return (N9) • Instrumentation (N11, N12) • Seal leak detection (N13)	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
			Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101
Nozzles • Instrumentation (N16)	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Nozzles • Instrumentation (N16)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Nozzles • Instrumentation (N16)	Pressure boundary	Carbon steel	Treated water (int) Neutron fluence	Reduction of fracture toughness	Reactor Vessel Surveillance TLAA – neutron fluence	IV.A1.RP-227 IV.A1.R-62	3.1.1-14 3.1.1-13	B A
Nozzles • Drain (N15)	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Nozzles • Drain (N15)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101
Nozzles • Feedwater (N4)	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Nozzles • Feedwater (N4)	Pressure boundary	Carbon steel	Treated water (int)	Cracking	BWR Feedwater Nozzle	IV.A1.R-65	3.1.1-95	A
Nozzles • Feedwater (N4)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101
Welds (nozzle to vessel) • Instrumentation (N11, N12, N16)	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	IV.E.RP-03	3.1.1-106	A
Welds (nozzle to vessel) • Instrumentation (N11, N12, N16)	Pressure boundary	Nickel alloy	Treated water (int)	Cracking	BWR Penetrations Water Chemistry Control – BWR	IV.A1.RP-369	3.1.1-98	A

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Welds (nozzle to vessel) • Instrumentation (N11, N12, N16)	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Safe Ends, Thermal Sleeves, Flanges, Caps, and Welds								
CRD return line cap (N9)	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	IV.E.RP-03	3.1.1-106	A
CRD return line cap (N9)	Pressure boundary	Nickel alloy	Treated water (int)	Cracking	BWR CRD Return Line Nozzle Water Chemistry Control – BWR	IV.A1.R-68	3.1.1-97	E
CRD return line cap (N9)	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Nozzle flanges • Vent (N7) • Spare instrumentation (N6) including blind flanges	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Nozzle flanges • Vent (N7) • Spare instrumentation (N6) including blind flanges	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Nozzle safe ends ≥ 4 inches • Recirculation outlets (N1) • Recirculation inlets (N2) • Jet pump instrumentation (N8)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
			Treated water > 140°F (int)	Cracking	BWR Stress Corrosion Cracking Water Chemistry Control – BWR	IV.A1.R-68	3.1.1-97	A
			Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Nozzle safe ends ≥ 4 inches • Core spray (N5)	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	IV.E.RP-03	3.1.1-106	A
Nozzle safe ends ≥ 4 inches • Core spray (N5)	Pressure boundary	Nickel alloy	Treated water (int)	Cracking	BWR Stress Corrosion Cracking Water Chemistry Control – BWR	IV.A1.R-68	3.1.1-97	A
Nozzle safe ends ≥ 4 inches • Core spray (N5)	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Nozzle safe ends and extensions ≥ 4 inches • Steam (N3) • Core spray (N5)	Pressure boundary	Carbon steel	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 Item	Table 1 Item	Notes
Nozzle safe ends and extensions ≥ 4 inches • Steam (N3) • Core spray (N5)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101
Nozzle safe ends ≥ 4 inches • Feedwater (N4)	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Nozzle safe ends ≥ 4 inches • Feedwater (N4)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101
Nozzle safe ends ≥ 4 inches • Feedwater (N4)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	C
Nozzle safe ends < 4 inches Core differential pressure (N10)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Nozzle safe ends < 4 inches • Core differential pressure (N10)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	BWR Penetrations Water Chemistry Control – BWR	IV.A1.RP-369	3.1.1-98	A

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Nozzle safe ends < 4 inches • Core differential pressure (N10)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Thermal sleeves ≥ 4 inches • Recirculation inlets (N2) • Core spray (N5)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-99	3.1.1-103	C
Thermal sleeves ≥ 4 inches Recirculation inlets (N2) • Core spray (N5)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	C, 101
Welds (nozzle to safe end) • Recirculation outlet (N1) • Recirculation inlet (N2) • Jet pump instrumentation (N8)	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	IV.E.RP-03	3.1.1-106	A
			Treated water (int)	Cracking	BWR Stress Corrosion Cracking Water Chemistry Control – BWR	IV.A1.R-68	3.1.1-97	A
			Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Shell and Heads								
Reactor pressure vessel • Top head	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Reactor pressure vessel • Top head	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-50	3.1.1-84	A, 101
Reactor pressure vessel • Top head/closure flange • Non-beltline shell rings/closure flange • Bottom head	Pressure boundary	Carbon steel clad with stainless steel	Air – indoor (ext)	None	None	--	--	G, 102
Reactor pressure vessel • Top head/closure flange • Non-beltline shell rings/closure flange • Bottom head	Pressure boundary	Carbon steel clad with stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.A1.R-68	3.1.1-97	E

Table 3.1.2-1: Reactor Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Reactor pressure vessel • Top head/closure flange • Non-beltline shell rings/closure flange • Bottom head	Pressure boundary	Carbon steel clad with stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101
Reactor pressure vessel • Beltline shell rings and connecting welds	Pressure boundary	Carbon steel clad with stainless steel	Air – indoor (ext)	None	None	--	--	G, 102
Reactor pressure vessel • Beltline shell rings and connecting welds	Pressure boundary	Carbon steel clad with stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.A1.R-68	3.1.1-97	E
Reactor pressure vessel • Beltline shell rings and connecting welds	Pressure boundary	Carbon steel clad with stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.A1.RP-157	3.1.1-85	A, 101

Table 3.1.2-1: Reactor Vessel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Reactor pressure vessel • Beltline shell rings and connecting welds	Pressure boundary	Carbon steel clad with stainless steel	Treated water > 140°F (int) Neutron fluence	Reduction of fracture toughness	Reactor Vessel Surveillance TLAA – neutron fluence	IV.A1.RP-227 IV.A1.R-62	3.1.1-14 3.1.1-13	B A

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 Item**	**Table 1 Item**	**Notes**
RV internals	Structural support Flow distribution Floodable volume	Stainless steel, nickel alloy	Treated water (ext)	Cracking – fatigue	TLAA – metal fatigue	IV.B1.R-53	3.1.1-3	A
Control rod guide tubes • Tube • Thermal sleeve	Structural support	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-104	3.1.1-102	A
Control rod guide tubes • Tube • Thermal sleeve	Structural support	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Control rod guide tubes • Base	Structural support	CASS	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-104	3.1.1-102	A
Control rod guide tubes • Base	Structural support	CASS	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Control rod guide tubes • Base	Structural support	CASS	Treated water > 482°F (ext)	Reduction of fracture toughness	BWR Vessel Internals	IV.B1.RP-220	3.1.1-99	A
Core support plate assembly	Structural support	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-93	3.1.1-103	A
Core support plate assembly	Structural support	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Core support plate rim hold-down bolts	Structural support	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-93	3.1.1-103	A
Core support plate rim hold-down bolts	Structural support	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Core support plate rim hold-down bolts	Structural support	Stainless steel	Treated water > 140°F (ext)	Loss of preload	BWR Vessel Internals	–	–	H
Core spray lines and spargers	Flow distribution	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-99	3.1.1-103	A

Table 3.1.2-2: Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Core spray lines and spargers	Flow distribution	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Fuel supports • Four lobed	Structural support	CASS	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-104	3.1.1-102	A
Fuel supports • Four lobed	Structural support	CASS	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Fuel supports • Four lobed	Structural support	CASS	Treated water > 482°F (ext) Neutron fluence	Reduction of fracture toughness	BWR Vessel Internals	IV.B1.RP-220	3.1.1-99	A
Fuel supports • Peripheral	Structural support	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-104	3.1.1-102	A
Fuel supports • Peripheral	Structural support	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Fuel supports • Orifices	Flow distribution	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-104	3.1.1-102	A

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Fuel supports • Orifices	Flow distribution	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Guide rods	Structural support	Stainless steel	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 101
Guide rods	Structural support	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
In-core instrument flux monitoring • Guide tube	Structural support	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-105	3.1.1-103	A
In-core instrument flux monitoring • Guide tube	Structural support	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
In-core instrument flux monitoring • Dry tube	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	C
In-core instrument flux monitoring • Dry tube	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.B1.R-105	3.1.1-103	E
In-core instrument flux monitoring • Dry tube	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Jet pump assembly • Riser pipe • Riser elbow • Riser braces • Hold-down bolt • Mixer throat (barrel) • Restrainer bracket adjusting screws for jet pumps • Slip joint clamp body • Diffuser shell • Diffuser tail pipe • Adapter ring (upper)	Floodable volume	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-100	3.1.1-103	A
			Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Jet pump assembly • Adapter ring (lower)	Floodable volume Structural Support	Nickel alloy	Treated water (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-100	3.1.1-103	A
Jet pump assembly • Adapter ring (lower)	Floodable volume Structural Support	Nickel alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101

Table 3.1.2-2: Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Jet pump assembly • Hold-down beam • Slip joint clamp adjustable bolt and ratchet lock spring	Floodable volume Structural Support	Nickel alloy (Alloy X-750)	Treated water (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-100	3.1.1-103	A
Jet pump assembly • Hold-down beam • Slip joint clamp adjustable bolt and ratchet lock spring	Floodable volume Structural Support	Nickel alloy (Alloy X-750)	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Jet pump assembly • Hold-down beam • Slip joint clamp adjustable bolt and ratchet lock spring	Floodable volume Structural Support	Nickel alloy (Alloy X-750)	Treated water (ext) Neutron fluence	Reduction of fracture toughness	BWR Vessel Internals	IV.B1.RP-200	3.1.1-99	A

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Jet pump assembly • Restrainer bracket • Auxiliary spring wedge assemblies	Structural Support	Nickel alloy (Alloy X-750)	Treated water (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-100	3.1.1-103	A
			Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
			Treated water (ext)	Loss of material – wear	BWR Vessel Internals	–	–	F
			Treated water (ext) Neutron fluence	Reduction of fracture toughness	BWR Vessel Internals	IV.B1.RP-200	3.1.1-99	A
Jet pump assembly • Transition piece • Suction inlet elbow • Suction inlet nozzle • Mixer adapter • Diffuser collar	Floodable volume Structural Support	CASS	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-100	3.1.1-103	A

Table 3.1.2-2: Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Jet pump assembly • Transition piece • Suction inlet elbow • Suction inlet nozzle • Mixer adapter • Diffuser collar	Floodable volume Structural Support	CASS	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Jet pump assembly • Transition piece • Suction inlet elbow • Suction inlet nozzle • Mixer adapter • Diffuser collar	Floodable volume Structural Support	CASS	Treated water > 482°F Neutron fluence	Reduction of fracture toughness	BWR Vessel Internals	IV.B1.RP-219	3.1.1-99	A
Jet pump assembly • Restrainer bracket wedge assembly • Restrainer bracket	Structural Support	CASS with stellite hard facing	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-100	3.1.1-103	A

Table 3.1.2-2: Reactor Vessel Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Jet pump assembly • Restrainer bracket wedge assembly • Restrainer bracket	Structural Support	CASS with stellite hard facing	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Jet pump assembly • Restrainer bracket wedge assembly • Restrainer bracket	Structural Support	CASS with stellite hard facing	Treated water > 140°F (ext)	Loss of material – wear	BWR Vessel Internals	IV.B1.RP-377	3.1.1-100	A
Jet pump assembly • Restrainer bracket wedge assembly • Restrainer bracket	Structural Support	CASS with stellite hard facing	Treated water > 482°F Neutron fluence	Reduction of fracture toughness	BWR Vessel Internals	IV.B1.RP-219	3.1.1-99	A
Shroud	Structural support Floodable volume	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-93	3.1.1-103	A

Table 3.1.2-2: Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Shroud	Structural support Floodable volume	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Shroud support plate and gussets	Structural support Floodable volume	Nickel alloy	Treated water (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-96	3.1.1-103	A
Shroud support plate and gussets	Structural support Floodable volume	Nickel alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Shroud support access hole cover at 180°	Floodable volume	Nickel alloy	Treated water (ext)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.B1.R-94	3.1.1-29	A
Shroud support access hole cover at 180°	Floodable volume	Nickel alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Shroud support access hole cover at 0°: cover and ring	Floodable volume	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-93	3.1.1-103	C

Table 3.1.2-2: Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Shroud support access hole cover at 0°: cover and ring	Floodable volume	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
0° access hole adapter ring	Floodable volume	Nickel alloy	Treated water (ext)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.B1.R-94	3.1.1-29	A
0° access hole adapter ring	Floodable volume	Nickel alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Steam dryer	Structural integrity	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.RP-155 –	3.1.1-101 –	A H, 104
Steam dryer	Structural integrity	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101
Top guide assembly	Structural support	Stainless steel	Treated water > 140°F (ext)	Cracking	BWR Vessel Internals Water Chemistry Control – BWR	IV.B1.R-98	3.1.1-103	A
Top guide assembly	Structural support	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.B1.RP-26	3.1.1-43	E, 101

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 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel, stainless steel	Air – indoor (ext)	Cracking – fatigue	TLAA – metal fatigue	IV.C1.RP-44	3.1.1-11	A
Reactor coolant pressure boundary components	Pressure boundary	Carbon steel, stainless steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	IV.C1.R-220	3.1.1-6	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	B
Bolting	Pressure boundary	High strength steel	Air – indoor (ext)	Cracking	Bolting Integrity	V.E.E-03	3.2.1-12	D
Bolting	Pressure boundary	High strength steel	Air – indoor (ext)	Loss of material	Bolting Integrity	IV.C1.RP-42	3.1.1-63	B
Bolting	Pressure boundary	High strength steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	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 Item**	**Table 1 Item**	**Notes**
Condensing chamber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Condensing chamber	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection One-Time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1.RP-230	3.1.1-39	A
Condensing chamber	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Flow element (HPCI and RCIC steam flow)	Pressure boundary Flow control	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Flow element (HPCI and RCIC steam flow)	Pressure boundary Flow control	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Flow element (main steam flow restrictors and recirculation)	Flow control	CASS	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 101
Flow element (main steam flow restrictors and recirculation)	Flow control	CASS	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101

Table 3.1.2-3: Reactor Coolant Pressure Boundary

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (reactor recirc pump cooler assembly)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	C
Heat exchanger (reactor recirc pump cooler assembly)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.C1.R-20	3.1.1-97	E
Heat exchanger (reactor recirc pump cooler assembly)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Heat exchanger (reactor recirc pump cooler assembly)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection Water Chemistry Control – Closed Treated Water Systems	V.D2.EP-98	3.2.1-28	C
Heat exchanger (reactor recirc pump cooler assembly)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	V.D2.EP-93	3.2.1-31	C

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (reactor recirc pump motor bearing oil cooling coils)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (ext)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 103
Heat exchanger (reactor recirc pump motor bearing oil cooling coils)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	V.D2.EP-94	3.2.1-32	C
Heat exchanger (reactor recirc pump motor bearing oil cooling coils)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	V.D2.EP-37	3.2.1-34	C
Orifice (instrument line)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Orifice (instrument line)	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Orifice (instrument line)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Orifice (instrument line)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	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 Item**	**Table 1 Item**	**Notes**
Orifice (instrument line)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.C1.R-20	3.1.1-97	E
Orifice (instrument line)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Orifice (instrument line) (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Orifice (instrument line) (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 101
Orifice (instrument line) (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Piping (flange seal leak detection)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Piping (flange seal leak detection)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	One-Time Inspection Water Chemistry Control – BWR	IV.A1.R-61	3.1.1-16	E
Piping (flange seal leak detection)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Piping (non-Class 1)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Piping (non-Class 1)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	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 Item	Table 1 Item	Notes
Piping (non-Class 1)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Piping (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Piping (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	C
Piping (non-Class 1)	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 103
Piping (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 101
Piping (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Piping < 4 inches NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Piping < 4 inches NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Piping < 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Cracking	Inservice Inspection One-Time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1.RP-230	3.1.1-39	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 Item	Table 1 Item	Notes
Piping < 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
Piping < 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Piping < 4 inches NPS	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Piping < 4 inches NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection One-Time Inspection – Small-Bore Piping Water Chemistry Control – BWR	IV.C1.RP-230	3.1.1-39	A
Piping < 4 inches NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Piping ≥ 4 inches NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Piping ≥ 4 inches NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	–	G, 102
Piping ≥ 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
Piping ≥ 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101

Table 3.1.2-3: Reactor Coolant Pressure Boundary

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping ≥ 4 inches NPS	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Piping ≥ 4 inches NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	BWR Stress Corrosion Cracking Inservice Inspection Water Chemistry Control – BWR	IV.C1.R-20	3.1.1-97	A
Piping ≥ 4 inches NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Pump casing and cover	Pressure boundary	CASS	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Pump casing and cover	Pressure boundary	CASS	Treated water > 140°F (int)	Cracking	BWR Stress Corrosion Cracking Inservice Inspection Water Chemistry Control – BWR	IV.C1.R-20	3.1.1-97	C
Pump casing and cover	Pressure boundary	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Pump casing and cover	Pressure boundary	CASS	Treated water > 482°F (int)	Reduction of fracture toughness	Inservice Inspection	IV.C1.R-08	3.1.1-38	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 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.C1.R-20	3.1.1-97	E
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Tubing (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Tubing (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	C
Tubing (non-Class 1)	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Valve body (flange seal leak detection)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Valve body (flange seal leak detection)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	One-Time Inspection Water Chemistry Control – BWR	IV.A1.R-61	3.1.1-16	E
Valve body (flange seal leak detection)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101

Table 3.1.2-3: Reactor Coolant Pressure Boundary								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body (non-Class 1)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Valve body (non-Class 1)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Valve body (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Valve body (non-Class 1)	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	C
Valve body (non-Class 1)	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Valve body (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 101
Valve body (non-Class 1)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Valve body < 4 inches NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Valve body < 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	A
Valve body < 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Valve body < 4 inches NPS	Pressure boundary	CASS	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	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 Item	Table 1 Item	Notes
Valve body < 4 inches NPS	Pressure boundary	CASS	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Valve body < 4 inches NPS	Pressure boundary	CASS	Treated water > 140°F (int)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.C1.R-20	3.1.1-97	E
Valve body < 4 inches NPS	Pressure boundary	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Valve body < 4 inches NPS	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Valve body < 4 inches NPS	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Valve body < 4 inches NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Inservice Inspection Water Chemistry Control – BWR	IV.C1.R-20	3.1.1-97	E
Valve body < 4 inches NPS	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Valve body ≥ 4 inches NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Valve body ≥ 4 inches NPS	Pressure boundary	Carbon steel	Air – indoor (ext)	None	None	--	--	G, 102
Valve body ≥ 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	IV.C1.R-23	3.1.1-60	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 Item**	**Table 1 Item**	**Notes**
Valve body ≥ 4 inches NPS	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Valve body ≥ 4 inches NPS	Pressure boundary	CASS	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Valve body ≥ 4 inches NPS	Pressure boundary	CASS	Treated water > 140°F (int)	Cracking	BWR Stress Corrosion Cracking Inservice Inspection Water Chemistry Control – BWR	IV.C1.R-20	3.1.1-97	A
Valve body ≥ 4 inches NPS	Pressure boundary	CASS	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101
Valve body ≥ 4 inches NPS	Pressure boundary	CASS	Treated water > 482°F (int)	Reduction of fracture toughness	Inservice Inspection	IV.C1.R-08	3.1.1-38	A

Table 3.1.2-4-1
Nuclear Boiler System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.1.2-4-1: Nuclear Boiler System, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	D
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	B
Condenser (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	C
Condenser (shell)	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D
Cylinder	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Cylinder	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 101
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 101
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C

Table 3.1.2-4-1: Nuclear Boiler System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	IV.C1.R-220	3.1.1-6	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 101
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	IV.C1.R-220	3.1.1-6	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 101
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101

Table 3.1.2-4-1: Nuclear Boiler System, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Tubing	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 101
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	D
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	IV.C1.R-220	3.1.1-6	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 101
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	IV.C1.R-220	3.1.1-6	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C

Table 3.1.2-4-1: Nuclear Boiler System, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 101
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	IV.C1.RP-158	3.1.1-79	A, 101

**Table 3.1.2-4-2
Reactor Recirculation System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation**

Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	D
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	IV.C1.RP-43	3.1.1-67	B
Cooler bonnet	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Cooler bonnet	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	V.D2.EP-92	3.2.1-30	C
Cooler shell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Cooler shell	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 103
Eliminator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Eliminator	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 103

Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 103
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Flex connection	Pressure boundary	Stainless steel	Waste water (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Flex connection	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Orifice	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 103
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Orifice	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 101
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C

Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 103
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	IV.C1.R-220	3.1.1-6	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 101
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 103
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 103

Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F.EP-15	3.2.1-60	C
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	V.F.EP-16	3.2.1-60	C
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	C
Tubing	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 103
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 103
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	C
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 103
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 101
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C

Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 103
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2.AP-32	3.3.1-72	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 101
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	IV.E.RP-04	3.1.1-107	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 103
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 101

Table 3.1.2-4-3
Neutron Monitoring System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.1.2-4-3: Neutron Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Piping	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D

3.2 ENGINEERED SAFETY FEATURES SYSTEMS

3.2.1 Introduction

This section provides the results of the aging management reviews for components in the engineered safety features (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).

- Nuclear Pressure Relief (Section 2.3.2.1)
- Residual Heat Removal (Section 2.3.2.2)
- Core Spray (Section 2.3.2.3)
- High Pressure Coolant Injection (Section 2.3.2.4)
- Reactor Core Isolation Cooling (Section 2.3.2.5)
- Containment Penetrations (Section 2.3.2.6)
- Standby Gas Treatment (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 Nuclear Pressure Relief System—Summary of Aging Management Evaluation
- Table 3.2.2-2 Residual Heat Removal System—Summary of Aging Management Evaluation
- Table 3.2.2-3 Core Spray 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
- Table 3.2.2-6 Containment Penetrations—Summary of Aging Management Evaluation

- Table 3.2.2-7 Standby Gas Treatment 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 System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-5 Containment Penetrations, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-6 Standby Gas Treatment System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

3.2.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the ESF systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.2.2.1.1 <u>Nuclear Pressure Relief System</u>

Materials

Nuclear pressure relief system components are constructed of the following materials.

- Carbon steel
- Stainless steel

Environments

Nuclear pressure relief system components are exposed to the following environments.

- Air – indoor
- Steam
- Treated water
- Treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the nuclear pressure relief 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 nuclear pressure relief system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.2 Residual Heat Removal System

Materials

Residual heat removal system components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Stainless steel

Environments

Residual heat removal system components are exposed to the following environments.

- Air – indoor
- Raw water
- Treated water
- Treated water > 140°F

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 preload

Aging Management Programs

The following aging management programs manage the effects of aging on the residual heat removal system components.

- Bolting Integrity
- External Surfaces Monitoring
- One-Time Inspection
- Service Water Integrity
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.2.2.1.3 Core Spray System

Materials

Core spray system components are constructed of the following materials.

- Carbon steel
- Stainless steel

Environments

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.

- Cracking – fatigue
- 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
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.4 High Pressure Coolant Injection System

Materials

High pressure coolant injection system components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc (inhibited)
- Glass
- Stainless steel

Environments

High pressure coolant injection system components are exposed to the following environments.

- Air – indoor
- Condensation
- Lube oil
- Steam
- Treated water
- Treated water > 140°F

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 preload

Aging Management Programs

The following aging management programs manage the effects of aging on the high pressure coolant injection system components.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.5 Reactor Core Isolation Cooling System

Materials

Reactor core isolation cooling 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
- Stainless steel

Environments

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 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
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.6 Containment Penetrations

Materials

Containment penetrations components are constructed of the following materials.

- Carbon steel
- Stainless steel

Environments

Containment penetrations components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Condensation
- Gas
- Treated water
- Waste water

Aging Effects Requiring Management

The following aging effects associated with containment penetrations components require management.

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on the containment penetrations components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.7 Standby Gas Treatment System

Materials

Standby gas treatment system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Fiberglass
- Glass
- Stainless steel

Environments

Standby gas treatment system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Concrete
- Waste water

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
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components

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.

- Aluminum
- Carbon steel
- Copper alloy > 15% zinc or > 8% aluminum
- Glass
- Stainless steel

Environments

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Concrete
- Condensation
- Gas
- Raw water
- Steam
- Treated water
- Waste water

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
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.2.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the Fermi 2 approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.2.2.2.1 Cumulative Fatigue Damage

Where fatigue is 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 paragraph in NUREG-1800 pertains to PWR steel charging pump casings with stainless steel cladding and is therefore not applicable to Fermi 2.

3.2.2.2.3 Loss of Material due to Pitting and Crevice Corrosion

1. This paragraph in NUREG-1800 pertains to loss of material due to pitting and crevice corrosion in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. Although this paragraph is referenced only by a PWR table line (V.D1.E-01) in NUREG-1801, it could also apply to BWR plants. However, the ESF systems at Fermi 2 do not include partially encased stainless steel tanks exposed to this environment. Therefore, this paragraph is not applicable.

2. Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. At Fermi 2, there are no stainless steel ESF system components within the scope of license renewal that are exposed to outdoor air or located near unducted air intakes. Therefore, this item was not used.

3.2.2.2.4 Loss of Material due to Erosion

This paragraph in NUREG-1800 pertains to PWR high pressure safety injection (HPSI) pump miniflow recirculation orifice and is therefore not applicable to Fermi 2.

3.2.2.2.5 Loss of Material due to General Corrosion and Fouling that Leads to Corrosion

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 Fermi 2 the containment spray nozzles are copper alloy and are not subject to loss of material due to general corrosion in an indoor air environment. There are no steel orifices in the containment spray subsystem of the residual heat removal system internally exposed to an indoor air environment. Therefore, this item was not used.

3.2.2.2.6 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. At Fermi 2, there are no stainless steel ESF system components in the scope of license renewal that are exposed to outdoor air or located near unducted air intakes. Therefore, this item was not used.

3.2.2.2.7 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of Fermi 2 quality assurance procedures and administrative controls for aging management programs.

3.2.2.2.8 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of Fermi 2 operating experience review programs.

3.2.2.2.9 Loss of Material due to Recurring Internal Corrosion

Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on recurring internal corrosion in the development of the license renewal application.

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

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
Table 3.2.1: Engineered Safety Features					
3.2.1-1	Stainless steel, steel piping, piping components, and piping elements exposed to Treated water (borated)	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA	Fatigue is a TLAA. See Section 3.2.2.2.1.
3.2.1-2	PWR only				
3.2.1-3	PWR only				
3.2.1-4	Stainless steel piping, piping components, and piping elements; tanks exposed to Air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated.	This item was not used. There are no stainless steel ESF system components exposed to outdoor air included in the scope of license renewal. See Section 3.2.2.2.3 Item 2.
3.2.1-5	PWR only				

Table 3.2.1: Engineered Safety Features

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-6	Steel Drywell and suppression chamber spray system (internal surfaces): flow orifice; spray nozzles exposed to Air – indoor, uncontrolled (Internal)	Loss of material due to general corrosion; fouling that leads to corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific	This item was not used. There are no steel orifices or spray nozzles exposed to indoor air in the containment spray subsystem of the residual heat removal system. See Section 3.2.2.2.5.
3.2.1-7	Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated	This item was not used. There are no stainless steel ESF system components exposed to outdoor air included in the scope of license renewal. See Section 3.2.2.2.6.
3.2.1-8	PWR only				
3.2.1-9	PWR only				

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-10	Cast austenitic stainless steel Piping, piping components, and piping elements exposed to Treated water (borated) >250°C (>482°F), Treated water >250°C (>482°F)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No	This item was not used. There are no cast austenitic stainless steel components exposed to treated water > 250°C (> 482°F) within the scope of license renewal that are outside the reactor coolant system pressure boundary.
3.2.1-11	Steel piping, piping components, and piping elements exposed to steam, treated water	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801. Loss of material due to flow-accelerated corrosion in steel components exposed to steam or treated water is managed by the Flow-Accelerated Corrosion Program.
3.2.1-12	Steel, high-strength closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Cracking of high-strength steel reactor coolant system closure bolting (Tables 3.1.2-X) is managed by the Bolting Integrity Program.

Table 3.2.1: Engineered Safety Features

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-13	Steel; stainless steel bolting, closure bolting exposed to air – outdoor (external), air – indoor, uncontrolled (external)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Loss of material for steel closure bolting exposed to indoor air is managed by the Bolting Integrity Program. Loss of material is not an aging effect for stainless steel closure bolting in indoor air unless exposed to prolonged leakage (an event-driven condition). Nevertheless, the Bolting Integrity Program also applies to stainless steel bolting exposed to indoor air. There is no ESF system bolting exposed to outdoor air in the scope of license renewal.
3.2.1-14	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	This item was not used. As stated in Item 3.2.1-13, loss of material of steel bolting exposed to air in the ESF systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-15	Copper alloy, nickel alloy, steel; stainless steel, stainless steel, steel; stainless steel bolting, closure bolting exposed to any environment, air – outdoor (external), raw water, treated borated water, fuel oil, treated water, air – indoor, uncontrolled (external)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Loss of preload for steel and stainless steel bolting is managed by the Bolting Integrity Program. Copper alloy and nickel alloy bolting is not included in the scope of license renewal for ESF systems.
3.2.1-16	Steel containment isolation piping and components (internal surfaces), piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel containment isolation and other ESF system components exposed to treated water 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.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-17	Aluminum, stainless steel piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for aluminum and stainless steel components exposed to treated water 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.
3.2.1-18	Stainless steel containment isolation piping and components (internal surfaces) exposed to treated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to treated water 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.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-19	Stainless steel heat exchanger tubes exposed to treated water, treated water (borated)	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Fouling of stainless steel heat exchanger tubes exposed to treated water 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 fouling. Fouling, as used in the Fermi 2 aging management review, is equivalent to the NUREG-1801 aging effect of reduction of heat transfer.
3.2.1-20	PWR only				
3.2.1-21	PWR only				
3.2.1-22	PWR only				
3.2.1-23	Steel heat exchanger components, containment isolation piping and components (internal surfaces) exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. Loss of material for steel ESF system components exposed to raw water is managed by the Service Water Integrity Program.
3.2.1-24	PWR only				

Table 3.2.1: Engineered Safety Features

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-25	Stainless steel heat exchanger components, containment isolation piping and components (internal surfaces) exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. Loss of material for stainless steel ESF system components exposed to raw water is managed by the Service Water Integrity Program.
3.2.1-26	Stainless steel heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. Fouling of stainless steel heat exchanger tubes exposed to raw water is managed by the Service Water Integrity Program.
3.2.1-27	Stainless steel, steel heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no steel ESF system heat exchanger tubes exposed to raw water in the scope of license renewal.

Table 3.2.1: Engineered Safety Features

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-28	Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	The Water Chemistry Control – Closed Treated Water Systems Program, supplemented by the Inservice Inspection Program, manages cracking of reactor recirculation pump cooler assembly subcomponents (Table 3.1.2-3) exposed to closed-cycle cooling water > 60°C (> 140°F). There are no stainless steel ESF system components exposed to closed-cycle cooling water > 60°C (> 140°F) in the scope of license renewal.
3.2.1-29	Steel Piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no steel ESF system piping components exposed to closed-cycle cooling water in the scope of license renewal.
3.2.1-30	Steel heat exchanger components exposed to closed-cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Loss of material of steel heat exchanger components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program.

Table 3.2.1: Engineered Safety Features

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-31	Stainless steel heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Loss of material of stainless steel heat exchanger components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program.
3.2.1-32	Copper alloy heat exchanger components, piping, piping components, and piping elements exposed to Closed-cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Loss of material of copper alloy heat exchanger components exposed to closed-cycle cooling water (Table 3.1.2-3) is managed by the Water Chemistry Control – Closed Treated Water Systems Program.
3.2.1-33	Copper alloy, Stainless steel Heat exchanger tubes exposed to Closed-cycle cooling water	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Fouling of stainless steel heat exchanger tubes exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. There are no ESF system copper alloy heat exchanger tubes exposed to closed-cycle cooling water with a heat transfer intended function in the scope of license renewal.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-34	Copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements, heat exchanger components exposed to closed-cycle cooling water	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Consistent with NUREG-1801. Loss of material due to selective leaching for copper alloy (> 15% Zn or > 8% Al) components (Table 3.1.2-3) is managed by the Selective Leaching Program.
3.2.1-35	PWR only				
3.2.1-36	PWR only				
3.2.1-37	Gray cast iron piping, piping components, and piping elements exposed to soil	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	This item was not used. There are no ESF system components exposed to soil in the scope of license renewal.
3.2.1-38	Elastomers, elastomer seals and components exposed to air – indoor, uncontrolled (external)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no elastomer ESF system components in the scope of license renewal.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-39	Steel containment isolation piping and components (external surfaces) exposed to condensation (external)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. Loss of material in steel components exposed to external condensation is managed by the External Surfaces Monitoring Program.
3.2.1-40	Steel ducting, piping, and components (external surfaces), ducting, closure bolting, containment isolation piping and components (external surfaces) exposed to air – indoor, uncontrolled (external)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. Loss of material of external surfaces of steel components exposed to indoor air is managed by the External Surfaces Monitoring Program.
3.2.1-41	Steel external surfaces exposed to air – outdoor (external)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. Loss of material of external surfaces of steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-42	Aluminum piping, piping components, and piping elements exposed to air - outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no aluminum ESF system components exposed to outdoor air in the scope of license renewal.
3.2.1-43	Elastomers elastomer seals and components exposed to air – indoor, uncontrolled (internal)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	This item was not used. There are no elastomer ESF system components in the scope of license renewal.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-44	Steel piping and components (internal surfaces), ducting and components (internal surfaces) exposed to air – indoor, uncontrolled (internal)	Loss of material due to general corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801 for most components. Loss of material from the internal surfaces of steel components exposed to air – indoor is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For some steel components (Tables 3.3.2-x), loss of material from internal surfaces exposed to air – indoor is managed by the Periodic Surveillance and Preventive Maintenance Program by periodic visual inspection of component internal surfaces. The External Surfaces Monitoring Program manages loss of material for external carbon steel components by visual inspection of external surfaces. For those components 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.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-45	PWR only				
3.2.1-46	Steel piping and components (internal surfaces) exposed to condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Loss of material from the internal surfaces of steel components exposed to condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.
3.2.1-47	PWR only				
3.2.1-48	Stainless steel piping, piping components, and piping elements (internal surfaces); tanks exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Loss of material from the internal surfaces of stainless steel components exposed to condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.
3.2.1-49	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material.

Table 3.2.1: Engineered Safety Features

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-50	Copper alloy, stainless steel (PWR only) piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for copper alloy components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material.
3.2.1-51	Steel, copper alloy, stainless steel heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Fouling of copper alloy heat exchanger tubes exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage fouling. There are no steel or stainless steel ESF system heat exchanger tubes exposed to lube oil with an intended function of heat transfer in the scope of license renewal.
3.2.1-52	Steel (with coating or wrapping) piping, piping components, and piping elements exposed to soil or concrete	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There are no buried or underground ESF system components exposed to soil or concrete in the scope of license renewal.

Table 3.2.1: Engineered Safety Features

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-53	Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There are no buried or underground ESF system components exposed to soil or concrete in the scope of license renewal.
3.2.1-53.5	Steel; stainless steel, nickel alloy underground piping, piping components, and piping elements exposed to air-indoor uncontrolled or condensation (external)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There are no buried or underground ESF system components exposed to condensation in the scope of license renewal.
3.2.1-54	Stainless steel piping, piping components, and piping elements exposed to treated water >60°c (> 140°f)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	This item was not used. Stainless steel components of the ESF systems subject to evaluation under the BWR Stress Corrosion Cracking Program were reviewed as part of the Class 1 reactor coolant pressure boundary (Table 3.1.2-3).

Table 3.2.1: Engineered Safety Features

Item Number	Component	Aging Effect/ Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-55	Steel piping, piping components, and piping elements exposed to concrete	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Consistent with NUREG-1801. Embedded steel components are in concrete that is designed and constructed in accordance with ACI and ASTM standards, which provide a good-quality, relatively high strength, dense, low-permeability concrete. This design is sufficient to preclude embedded steel corrosion for concrete not exposed to an aggressive environment. Operating experience indicates no significant aging related degradation of this concrete.
3.2.1-56	Aluminum piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.2.1-57	Copper alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.2.1-58	PWR only				

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-59	Galvanized steel ducting, piping, and components exposed to air – indoor, controlled (external)	None	None	NA - No AEM or AMP	This item was not used. Galvanized steel is evaluated as steel.
3.2.1-60	Glass piping elements exposed to air – indoor, uncontrolled (external), lubricating oil, raw water, treated water, treated water (borated), air with borated water leakage, condensation (internal/external), gas, closed-cycle cooling water, air – outdoor	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for glass components exposed to indoor air, lube oil and treated water. There are no glass ESF system components exposed to other environments in the scope of license renewal.
3.2.1-61	Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external)	None	None	NA - No AEM or AMP	This item was not used. There are no nickel alloy ESF system components exposed to indoor air in the scope of license renewal.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-62	Nickel alloy piping, piping components, and piping elements exposed to air with borated water leakage	None	None	NA - No AEM or AMP	This item was not used. There are no nickel alloy ESF system components exposed to indoor air in the scope of license renewal.
3.2.1-63	Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), air with borated water leakage, concrete, gas, air – indoor, uncontrolled (internal)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for stainless steel components exposed to indoor air and gas. There are no stainless steel ESF system components exposed to air with borated water leakage or concrete in the scope of license renewal.
3.2.1-64	Steel piping, piping components, and piping elements exposed to air – indoor, controlled (external), gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 for steel components exposed to gas. There are no steel ESF system components exposed to controlled indoor air in the scope of license renewal.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-65	Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated)	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801. Loss of material due to erosion for steel and stainless steel components is managed by the Flow-Accelerated Corrosion Program.
3.2.1-66	Metallic piping, piping components, and tanks exposed to raw water or waste water	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion	Yes, plant-specific	Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on recurring internal corrosion in the development of the license renewal application. (See Section 3.2.2.2.9.)
3.2.1-67	Stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Cracking due to stress corrosion cracking	Chapter XI.M29, "Aboveground Metallic Tanks"	No	There are no stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the engineered safety features systems.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-68	Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	There are no steel, stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the engineered safety features systems.
3.2.1-69	Insulated steel, stainless steel, copper alloy, or aluminum, piping, piping components, and tanks exposed to condensation, air-outdoor	Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks," (for tanks only)	No	Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on corrosion under insulation in the development of the license renewal application.

Table 3.2.1: Engineered Safety Features					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Program**	**Further Evaluation Recommended**	**Discussion**
3.2.1-70	Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water, treated borated water	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	There are no steel, stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the engineered safety features systems.
3.2.1-71	Insulated stainless steel, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only)	No	Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on corrosion under insulation in the development of the license renewal application.

Notes for Tables 3.2.2-1 through 3.2.2-8-6

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 has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect and aging management program listed 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 listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination 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 piping passes through the waterline region of suppression pool. The environment for the internal and external surfaces of the piping in this region may alternate between wet and dry. The One-Time Inspection Program will use visual or other NDE techniques to inspect this piping to manage the potential accelerated loss of material.

204. This steam environment for this component type is produced from and is equivalent to treated water for the purposes of evaluating loss of material due to erosion.

Table 3.2.2-1
Nuclear Pressure Relief System
Summary of Aging Management Evaluation

Table 3.2.2-1: Nuclear Pressure Relief System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Flex connection	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Flex connection	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Flex connection	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A

Table 3.2.2-1: Nuclear Pressure Relief System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Quencher	Pressure boundary Flow control	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H

Table 3.2.2-1: Nuclear Pressure Relief System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Quencher	Pressure boundary Flow control	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Quencher	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Screen	Filtration	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

Table 3.2.2-1: Nuclear Pressure Relief System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
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)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

Table 3.2.2-2
Residual Heat Removal System
Summary of Aging Management Evaluation

Table 3.2.2-2: Residual Heat Removal System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Flow element	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Flow element	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Flow element	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Flow element	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C

Table 3.2.2-2: Residual Heat Removal System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Flow element	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	V.D2.EP-90	3.2.1-23	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-77	3.4.1-15	C, 201
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	V.D2.EP-92	3.2.1-30	A
Heat exchanger (tube sheet)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-77	3.4.1-15	C, 201
Heat exchanger (tube sheet)	Pressure boundary	Stainless steel	Raw water (ext)	Loss of material	Service Water Integrity	V.D2.EP-91	3.2.1-25	A

Table 3.2.2-2: Residual Heat Removal System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Heat transfer	Stainless steel	Raw water (int)	Fouling	Service Water Integrity	V.D2.E-21	3.2.1-26	A
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	V.D2.EP-91	3.2.1-25	A
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water (ext)	Fouling	Water Chemistry Control – Closed Treated Water Systems	V.D2.EP-96	3.2.1-33	A
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	V.D2.EP-93	3.2.1-31	A
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water > 140°F (ext)	Fouling	Water Chemistry Control – BWR	V.D2.EP-74	3.2.1-19	A, 201
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 201
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 201

Table 3.2.2-2: Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water > 140°F (int)	Fouling	Water Chemistry Control – BWR	V.D2.EP-74	3.2.1-19	A, 201
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 201
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 201
Nozzle	Pressure boundary Flow control	Copper alloy	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	A
Nozzle	Pressure boundary Flow control	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 201
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C

Table 3.2.2-2: Residual Heat Removal System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2.E-29	3.2.1-44	E
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201

Table 3.2.2-2: Residual Heat Removal System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Separator	Pressure boundary Filtration	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Separator	Pressure boundary Filtration	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Separator	Pressure boundary Filtration	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Separator	Pressure boundary Filtration	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Strainer	Filtration	Stainless steel	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Strainer	Filtration	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Strainer	Filtration	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Strainer	Filtration	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A

Table 3.2.2-2: Residual Heat Removal System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2.E-29	3.2.1-44	E
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.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.EP-60	3.2.1-16	A, 201

Table 3.2.2-2: Residual Heat Removal System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.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.EP-73	3.2.1-17	A, 201

Table 3.2.2-3
Core Spray System
Summary of Aging Management Evaluation

Table 3.2.2-3: Core Spray System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 201
Bolting	Pressure boundary	Stainless steel	Treated water (ext)	Loss of preload	Bolting Integrity	V.E.EP-122	3.2.1-15	B
Expansion joint	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Expansion joint	Pressure boundary	Stainless steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Expansion joint	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

Table 3.2.2-3: Core Spray System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A

Table 3.2.2-3: Core Spray System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Separator	Pressure boundary Filtration	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Separator	Pressure boundary Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Strainer	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Strainer	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201

Table 3.2.2-3: Core Spray System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	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 Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 201
Bolting	Pressure boundary	Stainless steel	Treated water (ext)	Loss of preload	Bolting Integrity	V.E.EP-122	3.2.1-15	B
Condenser	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Condenser	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Flex connection	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 202
Flex connection	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Flex connection	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Heat exchanger (end channel)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	C
Heat exchanger (end channel)	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 201
Heat exchanger (fins)	Heat transfer	Carbon steel	Air – indoor (ext)	Fouling	External Surfaces Monitoring	--	--	H
Heat exchanger (shell)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	C

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 202
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 202
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 201
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Fouling	Oil Analysis	V.D2.EP-78	3.2.1-51	A, 202
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 202
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Fouling	Water Chemistry Control – BWR	VIII.E.SP-100	3.4.1-18	C, 201
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 201
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Orifice	Pressure boundary Flow control	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 202
Orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-27	3.2.1-46	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 201
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09 V.D2.E-408	3.2.1-11 3.2.1-65	A A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 201
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.A.SP-155	3.4.1-16	C, 201
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Pump casing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-27	3.2.1-46	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Separator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Separator	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Sight glass	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F.EP-15	3.2.1-60	A
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	V.F.EP-16	3.2.1-60	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	V.F.EP-29	3.2.1-60	A
Strainer	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Strainer	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 202
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 201
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis⁻	VII.C1.AP-138	3.3.1-100	C, 202
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 202
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 201
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.SP-155	3.4.1-16	C, 201
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

Table 3.2.2-4: High Pressure Coolant Injection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Turbine casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Turbine casing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-27	3.2.1-46	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09 V.D2.E-408	3.2.1-11 3.2.1-65	A A

Table 3.2.2-4: High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 202
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 201
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.A.SP-155	3.4.1-16	C, 201
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 201
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	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 Program	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	C, 201
Bolting	Pressure boundary	Stainless steel	Treated water (ext)	Loss of preload	Bolting Integrity	V.E.EP-122	3.2.1-15	B
Breather	Filtration	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Breather	Filtration	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2.E-29	3.2.1-44	E
Condenser	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Condenser	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Flex connection	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Heat exchanger (end channel)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	C
Heat exchanger (end channel)	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 201
Heat exchanger (shell)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	C
Heat exchanger (shell)	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 202

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 202
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 201
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Fouling	Oil Analysis	V.D2.EP-78	3.2.1-51	A, 202
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	C, 202
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Fouling	Water Chemistry Control – BWR	VIII.E.SP-100	3.4.1-18	C, 201
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 201
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Orifice	Pressure boundary Flow control	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 202
Orifice	Pressure boundary Flow control	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 201
Orifice	Pressure boundary Flow control	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Orifice	Pressure boundary Flow control	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	C, 201
Orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-07 V.D2.E-408	3.2.1-11 3.2.1-65	A A, 204
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 201
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09 V.D2.E-408	3.2.1-11 3.2.1-65	A A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	One-Time Inspection	--	--	G, 203
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 202

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 201
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.A.SP-155	3.4.1-16	C, 201
Piping	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Pump casing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-27	3.2.1-46	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Rupture disc	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Rupture disc	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Separator	Pressure boundary Filtration	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Separator	Pressure boundary Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Sight glass	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F.EP-15	3.2.1-60	A
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	V.F.EP-16	3.2.1-60	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	V.F.EP-29	3.2.1-60	A
Strainer	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Strainer	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

Table 3.2.2-5: Reactor Core Isolation Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	C, 202
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	C, 201
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Tubing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Tubing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 202
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 201
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.SP-155	3.4.1-16	C, 201
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Turbine casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Turbine casing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-27	3.2.1-46	A

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-77	3.2.1-49	A, 202
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-07 V.D2.E-408	3.2.1-11 3.2.1-65	A A, 204
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-09 V.D2.E-408	3.2.1-11 3.2.1-65	A A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	A
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 201
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	V.D2.EP-76	3.2.1-50	A, 202

Table 3.2.2-5: Reactor Core Isolation Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 202
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 201
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.A.SP-155	3.4.1-16	C, 201
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

Table 3.2.2-6
Containment Penetrations
Summary of Aging Management Evaluation

Table 3.2.2-6: Containment Penetrations								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.C.E-35	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-45	3.2.1-41	A
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-27	3.2.1-46	C
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	V.F.EP-7	3.2.1-64	A

Table 3.2.2-6: *Containment Penetrations*								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C.EP-62	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.EP-61	3.2.1-48	C
Piping	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F.EP-22	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C.EP-63	3.2.1-18	A, 201
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F.EP-22	3.2.1-63	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.C.E-35	3.2.1-40	A

Table 3.2.2-6: Containment Penetrations

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-45	3.2.1-41	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-27	3.2.1-46	C
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	V.F.EP-7	3.2.1-64	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C.EP-62	3.2.1-16	A, 201
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.EP-61	3.2.1-48	C
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F.EP-22	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.C.EP-63	3.2.1-18	A, 201

**Table 3.2.2-7
Standby Gas Treatment System
Summary of Aging Management Evaluation**

Table 3.2.2-7: Standby Gas Treatment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Chamber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Chamber	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Damper housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.B.E-26	3.2.1-40	A
Damper housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
Duct	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.B.E-26	3.2.1-40	A

Table 3.2.2-7: Standby Gas Treatment System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.B.E-26	3.2.1-40	A
Fan housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.B.E-26	3.2.1-40	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Filter housing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Flex connection	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A

Table 3.2.2-7: Standby Gas Treatment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Flow element	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Moisture separator	Filtration	Fiberglass	Waste water (ext)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G
Moisture separator	Filtration	Fiberglass	Waste water (ext)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G
Moisture separator	Filtration	Fiberglass	Waste water (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G
Moisture separator	Filtration	Fiberglass	Waste water (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G
Moisture separator	Filtration	Stainless steel	Waste water (ext)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.2.2-7: Standby Gas Treatment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Moisture separator	Filtration	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Orifice	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.B.E-26	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-45	3.2.1-41	A
Piping	Pressure boundary	Carbon steel	Concrete (ext)	None	None	V.F.EP-112	3.2.1-55	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.2.2-7: Standby Gas Treatment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Pump casing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F.EP-15	3.2.1-60	A
Sight glass	Pressure boundary	Glass	Air – indoor (int)	None	None	VII.J.AP-48	3.3.1-117	C
Sight glass	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Sight glass	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F.EP-3	3.2.1-56	A
Valve body	Pressure boundary	Aluminum	Air – indoor (int)	None	None	V.F.EP-3	3.2.1-56	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.B.E-26	3.2.1-40	A

Table 3.2.2-7: Standby Gas Treatment System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A

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, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2.E-29	3.2.1-44	E
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-45	3.2.1-41	A
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	V.E.E-46	3.2.1-39	A
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201

Table 3.2.2-8-1: Residual Heat Removal System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Pump casing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	V.E.E-46	3.2.1-39	A
Pump casing	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.D2.E-26	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.D2.E-29	3.2.1-44	E
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.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.EP-60	3.2.1-16	A, 201

Table 3.2.2-8-1: Residual Heat Removal System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	V.F.EP-82	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

**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, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

Table 3.2.2-8-2: *Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems*

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Strainer housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	V.F.EP-3	3.2.1-56	A
Valve body	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-71	3.2.1-17	A, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.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.EP-60	3.2.1-16	A, 201
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C

Table 3.2.2-8-2: Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	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, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C

Table 3.2.2-8-3: High Pressure Coolant Injection System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408	3.2.1-65	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	V.F.EP-15	3.2.1-60	A
Sight glass	Pressure boundary	Glass	Waste water (int)	None	None	VII.J.AP-277	3.3.1-119	C
Sight glass	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Sight glass	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	A

Table 3.2.2-8-3: High Pressure Coolant Injection System, Nonsafety-Related Components Affecting Safety-Related Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201

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, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 201
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A

Table 3.2.2-8-4: Reactor Core Isolation Cooling System, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 201
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.A.SP-155	3.4.1-16	C, 201
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	V.D2.E-408	3.2.1-65	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-73	3.2.1-17	A, 201
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 201
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	V.D2.EP-60	3.2.1-16	A, 201
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C

Table 3.2.2-8-5
Containment Penetrations
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.2.2-8-5: Containment Penetrations, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.E.E-44	3.2.1-40	A
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	V.F.EP-7	3.2.1-64	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	V.F.EP-18	3.2.1-63	A
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	V.F.EP-22	3.2.1-63	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	V.F.EP-10	3.2.1-57	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Gas (int)	None	None	V.F.EP-9	3.2.1-57	A

Table 3.2.2-8-6
Standby Gas Treatment System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.2.2-8-6: Standby Gas Treatment System, Nonsafety-Related Components Affecting Safety-Related Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	V.E.EP-70	3.2.1-13	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	V.E.EP-69	3.2.1-15	B
Duct	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	V.B.E-26	3.2.1-40	A
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	A
Duct	Pressure boundary	Carbon steel	Concrete (ext)	None	None	V.F.EP-112	3.2.1-55	C

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).

- Control Rod Drive (Section 2.3.3.1)
- Standby Liquid Control (Section 2.3.3.2)
- Service Water (Section 2.3.3.3)
- Fuel Pool Cooling and Cleanup (Section 2.3.3.4)
- Emergency Equipment Cooling Water (Section 2.3.3.5)
- Compressed Air (Section 2.3.3.6)
- Fire Protection – Water (Section 2.3.3.7)
- Fire Protection – CO_2 and Halon (Section 2.3.3.8)
- Combustion Turbine Generator (Section 2.3.3.9)
- Emergency Diesel Generator (Section 2.3.3.10)
- Heating, Ventilation and Air Conditioning (Section 2.3.3.11)
- Control Center Heating, Ventilation and Air Conditioning (Section 2.3.3.12)
- Containment Atmospheric Control (Section 2.3.3.13)
- Plant Drains (Section 2.3.3.14)
- Fuel Oil (Section 2.3.3.15)
- Primary Containment Monitoring and Leakage Detection (Section 2.3.3.16)
- Miscellaneous Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) (Section 2.3.3.17)

Table 3.3.1, Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the auxiliary systems component group. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.3.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for auxiliary systems.

- Table 3.3.2-1 Control Rod Drive System—Summary of Aging Management Evaluation
- Table 3.3.2-2 Standby Liquid Control System—Summary of Aging Management Evaluation
- Table 3.3.2-3 Service Water Systems—Summary of Aging Management Evaluation
- Table 3.3.2-4 Fuel Pool Cooling and Cleanup System—Summary of Aging Management Evaluation